Proceedings of CGAIDE'2004 : 5th Game-on international conference on computer games: Artificial intelligence, design and education, 8-10 November, 2004

CGAIDE'2004

5th International Game-On Conference
organised and sponsored by the University of Wolverhampton
on
Computer Games:
Artificial Intelligence, Design and Education

8-10 November, 2004

Microsoft Academic Campus

Reading UK

Programme and Abstracts

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David Al-Dabass

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Monday 8th November

Session 1 Opening

09.00-09.30 Monday 8th November

Introduction

Quasim Mehdi and Norman Gough
University of Wolverhampton

Welcome

Gavin King
Microsoft Academic, UK

Session 2 Keynote Presentation

09.30-10.30 Monday 8th November

Session Chair: Professor Norman E. Gough,
University of Wolverhampton

Grand theft academic: Stealing from six disciplines to build a model of interactive narrative in computer games

Professor R. Michael Young
Head of the Liquid Narrative Group,
North Carolina State University

OPENING SESSION

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Qasim Mehdi is Reader in Multimedia and Computer Games at the GSAI Centre, University of Wolverhampton. He received his MSc in microelectronics and PhD in Electrical Engineering from the University of Wales in 1979 and 1983. He held postdoctoral appointments at the Universities of Wales, Bradford and Surrey. His research interests include fuzzy logic, neural networks, DSP, microcontrollers, multimedia and computer game technology. He is carrying out research on the application of multimedia and artificial intelligence, including intelligent agents for games. He is the General Conference Chair for the annual *GAME-ON International Conference*, Chief Editor of *IJIGS*, the *International Journal of Intelligent Games and Simulation*, a Member of the Board of the *Society for Modelling Simulation - Europe*, and a founder member of the *Euopean Network for Digital Games Research*.

Norman Gough worked on the first computer control systems at ICI, graduated in Applied Physics with the Institute of Physics and obtained MSc and PhD degrees at the University of Bradford. He was a Professor of Systems Engineering at the University of Petroleum & Minerals in Dhahran, Saudi Arabia. He joined Wolverhampton as Head of Computer Aided Engineering and is currently Professor and Head of the Games Simulation and AI Centre. His current interests include AI, Petri nets, machine vision, intelligent agents, multimedia and computer games. He is the General Programme Chair for the annual *GAME-ON International Conference*, Chief Editor of *IJIGS*, the *International Journal of Intelligent Games and Simulatio*n and a founder member of the *Euopean Network for Digital Games Research*.

KEYNOTE PRESENTATION

GRAND THEFT ACADEMIC: STEALING FROM SIX DISCIPLINES TO BUILD A MODEL OF INTERACTIVE NARRATIVE IN COMPUTER GAMES

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ABSTRACT

In this paper, we set out a basic approach to the modeling of narrative in games. This approach adopts a bipartite model taken from narrative theory, in which narrative is composed of *story* and *discourse*. In our approach, story elements – plot and character – are defined in terms of plans that drive the dynamics of a virtual environment.

Sessions 3 and 4 are parallel sessions

Session 3 Tools and Systems for Games 1

11.00 – 13.00 Monday 8th November

Room A

Session Chair: Professor Yoshihiro Okada
Kyushu University, Japan

Hiromichi Fukutake, Yoshihiro Okada and Koichi Niijima
3D visual component based voice input/output interfaces for interactive 3D graphics applications

Burley, M. A., Gough, N. E., Mehdi, Q. H. and Natkin, S.
Encoding sound by polynomial interpolation for intelligent dynamic music in computer games

Charles, D. and Black, M.
Dynamic player modelling: A framework for player-centric digital games

Cheng, D. C. and Thawonmas, R.
Case-based plan recognition for real-time strategy games

3D VISUAL COMPONENT BASED VOICE INPUT/OUTPUT INTERFACES FOR INTERACTIVE 3D GRAPHICS APPLICATIONS

Hiromichi Fukutake[1], Yoshihiro Okada[1,2] and Koichi Niijima[1]
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KEYWORDS
3D Graphics software, *IntelligentBox*, Voice Commands, Voice Input Interface, Voice Output Interface.

ABSTRACT

A keyboard and a mouse device are still standard input devices used in 3D graphics software as well as in 2D software. However, the use of a keyboard or a mouse device is not suitable for wearable computer and augmented reality applications. For these kinds of applications, voice input/output interfaces are more significant. Moreover for physically handicapped persons, voice input/output interfaces are very useful. Then, the authors introduced voice input/output interfaces into *IntelligentBox*, which is a component based 3D software development system. This paper explains software components for voice input/output interfaces introduced into *IntelligentBox*. Furthermore, the authors describe their usefulness by showing their actual 3D graphics applications, e.g., 3D games.

BIOGRAPHY

Hiromichi Fukutake received his BSc in Physics from the Kyushu University, Japan, in 2004. Currently, he is a master course student in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include 3D graphics, software architecture and human-computer interface.

Yoshihiro Okada received his bachelor, master and doctoral degrees of Engineering from the Electrical Engineering Department, Faculty of Engineering, Hokkaido University, Japan, in 1988, 1990 and 1993 respectively.

Since April, 2000, he has been an Associate Professor in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include 3D graphics, software architecture, network collaboration technology, human-

Koichi Niijima received the BS degree, the MSc degree, and the PhD degree in Mathematics from the Kyushu University, Japan, in 1967, 1969 and 1977, respectively.

Since 1996, he has been a Professor in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include wavelets, in particular lifting wavelets, and their applications to image analysis and signal processing and geometric modeling.

ENCODING SOUND BY POLYNOMIAL INTERPOLATION FOR INTELLIGENT DYNAMIC MUSIC IN COMPUTER GAMES

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KEYWORDS
AI, Polynomial interpolation, sound, music, computer games.

ABSTRACT

Current research in computer music composition almost exclusively involves the manipulation of music stored as MIDI data. While this allows direct access to the structure of music, it creates limitations in realism for the end result of such techniques. This paper describes a method designed to represent music in a form that facilitates the use of existing processing techniques while conserving the 'real-world' attributes of music recorded in PCM format giving computer-game developers a facility for the production of variations on a pre-recorded theme, whatever the original source. Experimental results are presented to demonstrate that polynomial interpolation is a viable technique.

BIOGRAPHY

Matthew Burley graduated from the University of Wolverhampton with a BSc(Hons) in Computer Science in 2002 and is now a Lecturer at the institution teaching in the areas of Programming, Multimedia and Computer Games Development. He is currently undertaking a PhD on the subject of Dynamic Music for Computer Games as part of the university's Games, Simulation and Artificial Intelligence (GSAI) research group headed by Professor Norman Gough and Doctor Quasim Mehdi.

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Quasim Mehdi – see page 7

CASE-BASED PLAN RECOGNITION FOR REAL-TIME STRATEGY GAMES

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KEYWORDS
Case-based Plan Recognition, User modelling, Real-time strategy game

ABSTRACT

The current game industry around the world is one of the fastest growing industries. One gaming genre that is very popular is the real-time strategy games. However, current implementations of games apply extensive usage of FSM that makes them highly predictable and provides less replayability. Thus, this paper looks at the possibility of employing case-based plan recognition for NPCs so as to minimize their predictability. The paper also looks into possible representation adaptions to minimize the resource requirement to maintain the possibility of deployment in mobile devices.

BIOGRAPHY

Danny C. Cheng is currently a faculty member of the College of Computer Studies De La Salle University Manila Philippines. He finished his masteral degree on year 2000 and has been teaching of seven years. He is focusing on the research field of net centric computing which includes web based technologies, mobile technologies, networking, and applicability of other fields such as artificial intelligence to it.

Ruck Thawonmas is currently full professor at the Department of Human and Computer Intelligence, Ritsumeikan University in Japan. Since obtaining D. Eng. in 1994 from Tohoku University in Japan, he has been involved in research on soft computing in government, academia, and the private sector. His current research themes are on applications of artificial intelligence and computational intelligence techniques to interactive entertainment.

Sessions 3 and 4 are parallel sessions

Session 4 Graphics Developments and Simulation

11.00 – 13.00 Monday 8th November

Room B

Session Chairs: Professor David Al-Dabbas, Nottighnam Trent University, UK and Dr. Steve Maddock, Sheffield University, UK

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Programmable GPUs and shading languages: past, present and future

Langensiepen, C., Foster, G. and Cant, R.
GPU implementation of high quality bump mapping

Marshall, D., Delaney, D., McLoone, S. and Ward, T.
Representing random terrain on resource limited devices

Meredith, M. and Maddock, S.
Using a half-Jacobian for real-time inverse kinematics

Arokiasamy, A., Al-Dabass, D.,and Periyanayagam, R.
Simulating animation by regular deformation using OpenGL

GPU IMPLEMENTATION OF HIGH QUALITY BUMP MAPPING

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Nottingham Trent University
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KEYWORDS
Bump mapping, Cg, Hardware Accelerated Graphics.

ABSTRACT

This work addresses the removal of aliasing issues in bump and environment mapping via the use of multiple vectors in MIP mapping using current 3D graphics acceleration hardware.

Superficially the current generation of 3D graphics APIs are incompatible with the use of multiple vectors in MIP maps. Two approaches were undertaken in an attempt to try to overcome this problem. The first was based around the manipulation of texture coordinates to fix the multiple vector paradigm. It proved unsuccessful due to accuracy limitations, but future graphics hardware may well be able to employ it.

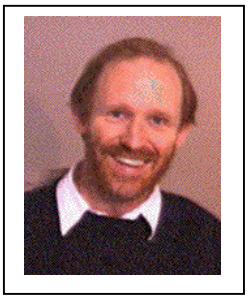
The second approach was based around the use of multi-texturing and limited to the use of two simultaneous vectors. Its implementation was a success, and resulted in a hardware rendered image where there was a noticeable difference between the single and double vector versions. Memory requirements of bump mapping with multiple vectors have been analysed, and found not to be taxing.

We therefore conclude that though the use of multiple vectors in MIP mapping on hardware accelerated platforms is currently somewhat awkward, the technique definitely has a future given the rapid and ongoing development of hardware programmability.

BIOGRAPHY

Dr. Langensiepen received a First class Honours degree in Physics from the University of Manchester in 1978. She then remained at Manchester to undertake research in theoretical particle physics, and was awarded a PhD in 1981. After a period as a physicist at the National Nuclear Corporation, she joined Ferranti Computer Systems of Stockport as a software designer. She spent 8 years there, working on high reliability systems and training simulators. She subsequently became an independant consultant, specialising in real time and object oriented design, especially as applied to very large systems. She has been the software design authority on a number of such systems, including a submarine command team training simulator, a safety-related plant management system, and a multinational radar system.

She joined the staff of the Dept. of Computing at Nottingham Trent University in 1996.



Dr Richard Cant received a First Class Honours Degree in Physics from the University of Manchester in 1975. After completing Part III of the Mathematics Tripos at the University of Cambridge in 1976, he undertook research in Theoretical Physics at Imperial College, London. He was awarded a PhD in 1980. He continued research in Theoretical Physics as a Research Assistant at the University of Manchester until 1982. For the following 9 years he worked as a System Designer for Ferranti Computer Systems in Stockport before returning to academic life as a Senior Lecturer at the then Nottingham Polytechnic in 1991. His current research interests centre around computer generated imagery and virtual reality. Present projects include the evaluation of image generator quality using neural networks and the refinement of texture mapping algorithms.

REPRESENTING RANDOM TERRAIN ON RESOURCE LIMITED DEVICES

DAMIEN MARSHALL[ϕ], DECLAN DELANEY[ϕ], SEAMUS MCLOONE*, TOMAS WARD*

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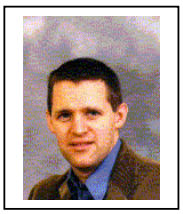
KEYWORDS
Random Terrain, Perlin Noise, Mobile Devices, Game Boy Advance

ABSTRACT

Random terrain generation is the procedural creation of a set of data that represents closely a believable landscape. Common techniques of achieving this include the use of fractals and noise. Such techniques usually require a large volume of memory, as the geometry of the terrain needs to be calculated and stored at run time. Given the limited memory available on mobile devices, such as mobile telephones, the storage of the data required to represent massive terrains can be difficult. In this paper, we propose a novel method of storing terrain data on devices with limited memory. This method involves placing pre-computed blocks of terrain, known as terrain tiles, together in a psuedo-random manner as governed by a noise function known as Perlin noise. This allows large amounts of terrain data to be represented while still giving the appearance of a randomly generated terrain. Traditionally, Perlin noise is used in the procedural generation of textures and the modeling of naturally occurring phenomena. Using Perlin noise, only a subset of the overall data generated by the function needs to be stored at any one time. The approach outlined in this paper associates a tile of terrain with each value generated by the Perlin Noise function, meaning that only a subsection of the total terrain is stored in memory at any one time. We show how this process can be executed in real time on a resource limited device known as the Game Boy Advance, and also illustrate a significant reduction in the memory requirements of terrain storage when compared with traditional methods.

BIOGRAPHY

Damien Marshall qualified in 2003 with an honours degree in Computer Science and Software engineering from the National University of Ireland, Maynooth. He is currently working towards a M. Sc, which he hopes to obtain in March 2005. As a member of the Distributed Interactive Applications Group in Maynooth, he is currently researching methods of dealing with latency in Distributed Interactive Applications or networked computer games.
He is also interested in computer games programming in general, including rendering mechanisms on devices with limited capabilities. He is a programmer for a newly established independent games developer who use the Torque game engine as a basis for their work.



Declan Delaney is a chartered electronic engineer with ten years industrial experience in programming and project management. He obtained an MScEng in 1999 and in 2001 began work on his PhD. This deals with network latency masking in distributed interactive systems. He is a founding member of the Distributed Interactive Systems Group in NUI Maynooth.

Using a Half-Jacobian for Real-Time Inverse Kinematics

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KEYWORDS
Inverse Kinematics, Computer Character Animation, Real-time

ABSTRACT

Due to their scalability, numerical techniques often form part of an inverse kinematics (IK) solver. However, because of their iterative nature, such methods can be slow. So far research into the field of kinematics has failed to find a general non-numerical solution to the problem. Many researchers have proposed hybrid techniques yet these still rely on a numerical aspect. It is therefore important to find ways of using numerical techniques as efficiently as possible. In this paper we take a look at the Jacobian-based IK solver and techniques that allow this method to be used as an efficient real-time IK solver. We demonstrate how the half-Jacobian can be used effectively where normally the full Jacobian would be considered the principal technique. The result of this is much reduced computational costs when applying IK to articulated characters.

BIOGRAPHY

Michael Meredith is a postgraduate student in the Department of Computer Science at the University of Sheffield, UK. He holds a First Class BEng (with Honours) in Software Engineering from the University of Sheffield. His research interests are in the field of computer character animation, which include the use of kinematic and dynamic simulation and adaptation techniques.

Steve Maddock is a lecturer in computer science at the University of Sheffield, UK. He received his PhD in computer science from the University of Sheffield in 1999. His research interests include modelling and animating deformable objects, computer facial animation and human figure animation.

Sessions 5 and 6 are parallel sessions

Session 5 Tools and Systems for Games 2

14.00 – 16.00 Monday 8th November

Room A

Session Chair: Don Anderson, Intellas Group, USA

Hastings, E. J., Mesit, J., Guha, R. K.
T-Collide: A temporal, real-time collision detection technique for bounded objects

Mesit, J., Guha, R. K. and Hastings, E. J.
Optimized collision detection for flexible object in a large environment

Hartley, T., Mehdi, Q. H. and Gough, N. E.
Applying Markov decision processes to 2D real-time games

Bancroft, M. and Al-Dabass, D.
A combat simulator for dungeons and dragons

T-Collide: A Temporal, Real-Time Collision Detection Technique for Bounded Objects

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KEYWORDS

temporal, continuous, real-time collision detection, uniform spatial subdivision, spatial hashing, bounding volumes, T-Collide

ABSTRACT

This paper presents T-Collide: a fast, low memory-overhead, low execution-cost, time-based collision detection scheme. It is intended for real-time systems such as games or simulations to optimize collision detection between large numbers of mobile objects. Nearly all aspects of T-Collide are fully customizable to application specifics or implementer preference. T-Collide is based upon Spatial Subdivision, Bounding Volumes, Spatial Hashing, Line Raster Algorithms, and Continuous, or Time-Based Collision.

BIOGRAPHY

Mr. Hastings is currently a Ph.D. student at the University of Central Florida. He received a M.Sc. in Computer Science at the University of Central Florida and a B.Sc. in Computer Information Science and Business from the University of Florida. His current areas of research include collision detection, graphics, and networked simulations.

Ms. Mesit has been a Ph.D. student at University of Central Florida since 2002. She got her M.Sc. in computer science and B.Sc. in computer science from NIDA (National of Development Administration) and Rajabhat Institute Phetchaburi Thailand, respectively. She is working as a graduated research assistant with Dr.Ratan Guha. Her research area is computer graphics in collision detection for flexible objects such as cloth, soft bodies, and water.

Dr. Ratan Guha is a professor at the department of Computer Science, University of Central Florida, with primary interests in Computer Networks, Distributed Computing, Distributed Simulation, and Computer Graphics. He received his Ph.D. from the University of Texas at Austin, and his M.Sc. in Applied Mathematics, and B.Sc. with honors in Mathematics from the Calcutta University, India.

OPTIMIZED COLLISION DETECTION FOR FLEXIBLE OBJECT IN A LARGE ENVIRONMENT

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KEYWORDS

collision detection, multi-resolution method, hash grid function, location tracking, flexible body

ABSTRACT

We present a scheme for collision detection of flexible models. This scheme relies on a multi-resolution technique of: 1) object location tracking to decrease time complexity, 2) the combination of bounding boxes (AABBs) and a hash grid function, and 3) computation of distance domain to determine collision with a contact surface. Experiments show that this approach can efficiently detect collisions in a large set of flexible objects.

BIOGRAPHY

Ms. Mesit has been a Ph.D. student at University of Central Florida since 2002. She got her M.Sc. in computer science and B.Sc. in computer science from NIDA (National of Development Administration) and Rajabhat Institute Phetchaburi Thailand, respectively. She is working as a graduated research assistant with Dr.Ratan Guha. Her research area is computer graphics in collision detection for flexible objects such as cloths, soft body, and water.

Dr. Ratan Guha is a professor at the department of Computer Science, University of Central Florida, with primary interests in Computer Networks, Distributed Computing, Distributed Simulation, and Computer Graphics. He received his Ph.D. from the University of Texas at Austin, and his M.Sc. in Applied Mathematics, and B.Sc. with honors in Mathematics from the Calcutta University, India.

Mr. Hastings is currently a Ph.D. student at the University of Central Florida. He received a M.Sc. in Computer Science at the University of Central Florida and a B.Sc. in Computer Information Science and Business from the University of Florida. His current areas of research include collision detection, graphics, and networked simulations.

APPLYING MARKOV DECISION PROCESSES TO 2D REAL TIME GAMES

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KEYWORDS
Markov decision processes, value iteration, artificial intelligence (AI), AI in computer games.

ABSTRACT

This paper presents the outcomes of a research project into the field of artificial intelligence (AI) and computer game AI. The project considered the problem of applying AI techniques to computer games. Current commercial computer games tend to use complex scripts to control AI opponents. This can result in poor and predictable gameplay. The use of academic AI techniques is a possible solution to overcome these shortcomings. This paper describes the process of applying Markov decision processes (MDPs) using the value iteration algorithm to a 2D real time computer game. We also introduce a new stopping criterion for value iteration, which has been designed for use in computer games and we discuss results from experiments conducted on the MDPs AI engine. This paper also outlines conclusions about how successful MDPs are in relation to a real computer game AI engine and how useful they might be to computer games developers.

BIOGRAPHY

Thomas Hartley is a PhD research student at the University of Wolverhampton in the field of Artificial Intelligence and it currently working on research in the area of learning from observation and computer games. Thomas holds a BSc (Hons) in computer science from the University of Wolverhampton.

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Sessions 5 and 6 are parallel sessions

Session 6 Games Art, Design, Modelling and Development

14.00 – 16.00 Monday 8th November

Room B

Session Chairs: Professor Marc Cavazza, University of Teesside, UK and Dr. Stefan Grünvogel, NOMADS Lab, Cologne, FRG

Bangsø, O., Jensen, O. G., Jensen, F. V., Andersen, P. B. and Kocka, T.
Non-linear interactive storytelling using object-oriented Baysian networks

Fairclough, C.R. and Cunningham, P.
AI structuralist storytelling in computer games

Natkin, S., Vega, L. and Grünvogel, S. M.
A new methodology for spatiotemporal game design

Röber, N. and Masuch, M.
Auditory game authoring from virtual worlds to auditory environments

Zeng, X., Mehdi, Q. H. and Gough, N. E.
Implementation of VRML and Java for Story Visualization Tasks

NON-LINEEAR INTERACTIVE STORYTELLING USING OBJECT-ORIENTED BAYESIAN NETWORKS

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KEYWORDS
Interactive narrative, Interactive drama, Object-oriented Bayesian networks.

ABSTRACT

Narration and interaction are often viewed as contrary properties in computer games. Games with a high degree of interaction fail to provide a coherent narration and the player's interaction seldom has any direct impact on the narrative. Games with a high degree of narration often tells a linear story similar to books or movies with little room for the player to interact. We propose *non-linear interactive storytelling* (NOLIST) as a first step towards developing games with a high degree of interaction and a coherent narrative. The main idea is that the narrative is not fixed from the beginning but instead constructed as the game progresses based on the players interaction. We provide a simple model that allows writers to specify a NOLIST as a set of *actions* which the game engine then combines to create the narrative. Finally we propose to develop a game engine using Bayesian networks to model the probability of the possible narratives that can be created from the actions, and use this knowledge to create better narratives.

BIOGRAPHY

Olav Bangsø: Assistant Professor at Department of Computer Science, Decision Support Systems Group, Aalborg University. M.Sc, Phd. In Computer science. Research interests include: Applying Bayesian networks, especially in the field of interactive narratives and representation of Bayesian networks.

AI STRUCTURALIST STORYTELLING IN COMPUTER GAMES

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ABSTRACT

This paper is a description of our work in creating a story director agent which utilises AI techniques. The story director controls the storyline in an adventure computer game, with the player controlling the hero character, and the story director reacting to the player's actions. The story is told through subplot-level plans being formulated with a case-based planner, and a social simulation system that the story director is 'plugged in to', allowing consistent logical stories while allowing for player freedom. The system has been named OPIATE – Open-ended Proppian Interactive Adaptive Tale Engine.

AI in storytelling was first concerned with story generation as text. In the seventies, Meehan's Talespin (Meehan 1977) generated much interest as a simple computer storyteller that utilised character-level planning. Later, Turner's Minstrel (Turner 1992) expanded on this to include author-level goals in a case-based planner. Our approach is to apply some of these AI techniques to creating a story for a computer game, where the player has an effect on the unfolding and the outcome of the story. To facilitate this, an author must give up some control over the story he wants to tell, and allow abstractly defined models to carry out story directions on his behalf. OPIATE was developed in order to facilitate the creation of next-generation tools so that story authors will be able to work in more complex simulated interactive worlds.

AUDITORY GAME AUTHORING
FROM VIRTUAL WORLDS TO AUDITORY ENVIRONMENTS.

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KEYWORDS

Authoring, sound, auditory environments, audio-only applications, sonification, interaction.

ABSTRACT

The majority of information that we perceive from our real-world environment is of audio-visual nature. Virtual worlds, which are utilized in computer games to line out the story's stage, are composed of visual and auditory environments. These environments are designed to provide sufficient information for the interaction and exploration of these worlds. The authoring – or content creation – of such environments can be a very tedious and time consuming task.
In this paper we focus on a specific chapter of game authoring: The authoring of auditory environments for virtual worlds. Many of the tools available for auditory authoring focus on visual cues rather than on auditory cues and common hearing behaviour. We compare several existing programs towards their applicability for authoring audio-visual as well as audio-only applications. In addition, we propose a new system, that allows the authoring of auditory environments through a non-visual interface by solely utilizing sound and specially designed interaction techniques.
Our work is motivated by the current development of such an authoring system for virtual, auditory spaces. The implementation is work in progress and currently exists as prototypic application.

BIOGRAPHY

Niklas Röber received his Diplom (Master's degree) from the Otto-von-Guericke University of Magdeburg in 2002. He is currently working on his PhD, focusing on sonification and interaction techniques for virtual, auditory worlds. His current research interests include auditory interfaces, acoustic rendering as well as non-photorealistic rendering techniques. Previous work contains research in computer graphics and scientific visualization. He is a member of the IGDA Society.

Maic Masuch PhD in computer animation, graduated at University of Magdeburg, Germany where he is now Germany's first professor for computer games. He has been teaching and researching on computer game programming for six years.
Research focuses on authoring of virtual worlds, user interfaces, audio-only-interfaces and graphics for games, especially real-time non-photorealistic rendering techniques for game engines. He supervised several game-related student projects and works as a game consultant for game development companies and the German ministry of research. In addition, Prof. Masuch is co-founder of Impara, a technology think tank that is developing media systems for playful learning.

Sessions 7 and 8 are parallel sessions

Session 7 Mobile and Multiuser Games

16.30 – 18.30 Monday 8th November

Room A

Session Chair: Professor Stéphane Natkin, CNAM, Paris, France

Bartle, R. A.
Massively multihero: Why people play virtual worlds

Simatic, M., Craipeau, S., Beugnard, A., Chabridon, S., Legout, M-C. and Gressier, E.
Technical and usage issues for mobile multiplayer games

Kim, S. Y., Chu, C.-W. and Lee, E.-H.
Development of a 3D game engine and a pilot game for PDA

McCoy, A., Delaney, D., McLoone, S. and Ward, T.
Towards statistical client prediction-analysis of user behaviour in distributed interactive media

Thorn, D. and Slater, S. I.
MMORPG on Mobile Devices? Considerations when designing distributed adventure games

Spyridou, E., Palmer, I. and Williams, E.
Investigating team speech communication in FPS video games

MASSIVELY MULTIHERO: WHY PEOPLE PLAY VIRTUAL WORLDS

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KEYWORDS

Virtual worlds, MMORPGs, design, hero's journey.

ABSTRACT

Designers of virtual worlds have known for some time that different people want different things from these creations. Modern designs are therefore broadened to account for playing styles beyond those that the designers themselves prefer. The results are patchy, however: although designers know intellectually what players want, they don't always know emotionally why they want them, and have over- and under-emphasised features as a result. More dangerously, they have deliberately denied some critical player needs in the false belief that to allow them would cause their virtual world to fail.

This paper examines why players play virtual worlds, and identifies a key area where designers are getting it wrong.

BIOGRAPHY

Richard Bartle co-wrote the first virtual world, *MUD*, in 1978; he has thus been at the forefront of virtual worlds from their very inception. His research interests extend to all fields with anything to say about virtual worlds; his influential 2003 book, *Designing Virtual Worlds*, touched on a great many of these, and has been hailed by leading designers as a foundational text. Dr Bartle is currently Visiting Professor of computer game design at Essex University.

TECHNICAL AND USAGE ISSUES FOR MOBILE MULTIPLAYER GAMES

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** CNAM-CEDRIC; 292 rue Saint Martin; FR-75141 Paris Cedex 03; France
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KEYWORDS
Multiplayer mobile games, technical issues, sociological issues, psychological issues

ABSTRACT

This paper presents the results of an undergoing project dealing with issues for mobile multiplayer games. First it takes a technical point of view. It presents our work-in-progress on the following issues: Communication middleware (through a prototype compliant to the *Open Mobile Alliance* specifications), high level communication abstractions (which can be provided to multiplayer games), latency awareness (through a prototype mixing high latency GPRS communications with low latency Bluetooth communications), consistency (taking into account mobile phone limited resources), and databases (investigating three solutions based on grid DBMS). Our work also studies sociological and psychological aspects. After presenting the methodology used for the study, it shows how mobile gaming provides a second skin to its player (giving him the ability to withdraw from others, or to stay present to them), and is a tool for socialisation and appropriating time (by favouring a feeling of mastery). This last point suggests that mobile multiplayer games can only be appreciated if they take into account player's time constraints.

BIOGRAPHY

Michel Simatic graduated from *Institut d'Informatique d'Entreprise* and received a DEA in Computer systems from the *University of Paris 6-Pierre et Marie Curie* in 1990. Then he joined telecom manufacturer *Alcatel*. There he first worked as a research engineer: His main subject was to provide high availability to an object-oriented process control supervision system. Afterwards he became a system architect mainly responsible for specifying architectures designed to interface *Alcatel*'s products with customers' applications. He finally worked as a team leader. In 2003, Michel Simatic joined *Institut National des Télécommunications* (*Groupe des Écoles des Télécommunications*) as lecturer/researcher. He gives courses on operating systems, middleware and algorithmic. His research field concerns massively multiplayer games in mobile environment

Doctor Sylvie Craipeau, professor in sociology, at *Institut National des Télécommunications* (*Groupe des Écoles des Télécommunications*) is member of *International Sociological Association*, and *Société Française des Sciences de l'Information et de la Communication*. She studies computer games since 2002 (she organized workshop "Internet, jeu et socialisation" in *Groupe des Écoles de Télécommunications* in December 2002). Her other research fields concern the social dimensions about new technologies especially in the space of work, and biometrics. Her main publications are:

- Auray N. and S. Craipeau. 2003. *Les jeux en ligne*, Lavoisier Hermes.
- Craipeau S. and M-C Legout. 2003. "La sociabilité mise en scène, entre réel et imaginaire." In *La pratique du jeu vidéo : réalité ou virtualité ?*, M. Roustan, L'Harmattan.
- Craipeau S., N. Auray and B. Seys. 2003. "Technologies de l'information et de la communication et sociabilté dans les jeux." Report. Groupe des Écoles des Télécommunications.
- Craipeau S. 2001. *L'entreprise commutante, travailler ensemble séparément*, Hermes Lavoisier.
- Boussard V., S. Craipeau, E. Drais, O. Guillaume, J-L Metzger. 2002. *Le socio manager*. Dunod (Manpower price in 2004).
- Craipeau S., G. Dubey and X. Guchet. 2004. "Les usages sociaux de la biométrie." Report. Groupe des Écoles des Télécommunications.

DEVELOPMENT OF A 3D GAME ENGINE AND A PILOT GAME FOR PDA

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KEYWORDS
Mobile 3D game, 3D engine, 3D puzzle, PDA device.

ABSTRACT
The advancement of computer graphics and hardware technology have nourished handheld or mobile devices to be equipped with fully implemented 3D graphics capabilities such as a 3D game. In this paper, we describe a development of 3D game engine for PDA device based on PocketPC and a pilot game, 3D Puzzle, implemented by our 3D game engine. The engine developed by us shows 8~9 fps speed rendering about 850 polygons with texture under landscape flush mode.

BIOGRAPHY

Sung-Ye Kim
I'm a researcher in ETRI, Korea. I was received a B.S. in computer science and engineering in 1998 and a M.S. in 2000 from Chung-Ang Univ. in Korea. My research interests include computer graphics, 3D rendering, image-based rendering and lighting, global illumination, inverse rendering and 3D game.

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I'm a researcher in ETRI, Korea. I was received a B.S. in computer science and engineering in 1999 and a M.S. in 2001 from KyungPook Univ. in Korea. My research interests include computer graphics, image-based modeling and rendering and online game.

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I'm a researcher in ETRI, Korea. I was received a B.S. in electronics and engineering in 2000 and a M.S. in 2002 from Hongik Univ. in Korea. My research interests include game, computer graphics and virtual reality.

TOWARDS STATISTICAL CLIENT PREDICTION – ANALYSIS OF USER BEHAVIOUR IN DISTRIBUTED INTERACTIVE MEDIA

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KEYWORDS
Distributed interactive media, Torque game engine, Time-series data analysis, Behavioural modeling, Statistical client prediction, Networked multiplayer games, Dead-reckoning.

ABSTRACT

Distributed interactive media such as networked multiplayer computer games offer users the opportunity to interact and share experiences within a virtual environment. More often than not, these interactions are required to be performed in real-time, a constraint which poses problems given the underlying network capabilities used to transmit information. In these real-time distributed systems, the amount of information that needs to be shared between participants in order to maintain complete game-state fidelity is too large. As a result, trade-offs must be made over what information requirements are necessary to maintain a level of consistency that will provide adequate quality of interaction for the users. One possible solution to this problem is the use of statistical modeling techniques that attempt to capture the individual behaviour of system users. These models can then be used to predict the likely future behaviour for the users, thus reducing the shared information requirements. In this paper we present some preliminary analysis of the behaviour of users within a distributed interactive application, with a goal towards future work of attempting to develop and incorporate statistical models of user behaviour for the purpose described above.

BIOGRAPHY

Aaron McCoy received his B.Sc. degree from the National University of Ireland, Maynooth in 2002, specializing in computer science and theoretical physics. His main areas of interest are distributed systems, networked virtual environments and the use of artificial intelligence in interactive games. He is currently studying for his PhD at NUI Maynooth in the area of user modeling in Distributed Interactive Applications.

Dr. Ward received the B.E., the M.Eng.Sc. and Ph.D degrees from University College, Dublin, Ireland in 1994, 1996 and 1999 respectively. He worked as Research Coordinator in the Rehabilitation Engineering Department at the National Rehabilitation Hospital from 1996-1999. From 1999-2000 he was an Assistant Lecturer in the Department of Computer Science at the National University of Ireland, Maynooth. In 2000 he became a lecturer in the Department of Electronic Engineering at NUI Maynooth. His main research interests lie in the areas of near-infrared optical and terahertz medical imaging, the development of therapeutic tools in medical rehabilitation, emotion synthesis in artificial speech and distributed environments for multi-user interaction.

INVESTIGATING TEAM SPEECH COMMUNICATION IN FPS VIDEO GAMES

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KEYWORDS

Speech communication, human-agent teams, multimodal interface, video games

ABSTRACT

Speech is natural. It evolved in response to human need for communication (Spyridou 2004). Participants tend to take turns in speaking, whilst giving constant non verbal feedback in the form of body language (Spyridou 2004; Shmandt 1994). A conversation involves at least two or more participants, who share knowledge in turns providing a mutual feedback. An advanced conversational system should not only speak and listen, but also understand, pose questions and take turns in a conversation. In this paper we investigate how users communicate with their teammates in a team multiplayer FPS video game. How they use speech to seek information, ask for help, describe situations, give explanations, instructions and commands. If the user is to feel comfortable playing alongside an agent, trust it and be persuaded by it, it is then vital to understand first how human users perform these functions and then provide the agent with similar behaviour. The experimental framework has features that have been emulated from the Unreal Tournament™ and Call of Duty™ video games.

BIOGRAPHY

Eleni Spyridou received her PhD and BSc (Hons) in 2004 and 2000 respectively at the University of Bradford, and has a degree in DeskTop Publishing from the Vocational Training Institute "DOMH", in Athens, Greece. Her current research focuses on conversational human-agent team video games using natural language, statistical Natural Language Processing and multimodal interfaces. Her aspiration is to produce a system with a seamless vocal interaction with the human user. She is a member of IEEE and an Expert Evaluator/Reviewer for the European Commission. She enjoys playing FPS and online fantasy RPG video games, her favourites are UT2003, Team Fortress and Kings of Chaos. In her leisure time she is interested in calligraphy and collects stationary. Contact her at: e.spyridou@btopenworld.com

Ian Palmer is currently head of the Electronic Imaging and Media Communications Department at the University of Bradford. He has an MSc in Digital Systems from Brunel University and a DPhil in Computer Animation from the University of Sussex. He is a member of the IEE, IEEE, Eurographics and SIGGRAPH. His current research interests centre on intelligent virtual environments, including emergent systems for computer games and multimodal interfaces. For recreation he enjoys games, films, music, photography and following the ups and downs of Tottenham Hotspur. When time allows he's trying to keep a Triumph Stag from the breakers yard after failing to do so for a series of classic cars. If he had to choose he would probably say that his favourite games were Tempest, Goldeneye and Metal Gear Solid. He is currently trying to find the time to move up the Project Gotham Racing 2 league so that he is not humiliated by his students. Contact him at: i.j.palmer@bradford.ac.uk

Elric Williams is currently lecturer in Media Technology at the Faculty of Media at Trinity and All Saints College, Leeds. Research interests evolve around games, gaming and military history. Particularly, interactivity and gameplay improvements that can be made with multimodal interfaces, especially those that utilise speech. He is interested in changing the perspective of the game player and their relationship to the game. He is naturally an avid gamer and is playing Call of Duty online and Evil Genius at the moment. For recreation he researches military history with a special interest in Napoleons enemies and allies. His wish is to combine his passion for militaria with his research interests and eventually design realistic war games for the rest of his life. Contact him at: **e.j.williams@TASC.ac.uk**

Sessions 7 and 8 are parallel sessions

Session 8 Neural Networks in Games

16.30 – 18.30 Monday 8th November

Room B

Session Chairs: Dr. S. McGlinchey, University of Paisley, UK and Dr Darryl Charles, University of Ulster, UK

Charles, D. and McGlinchey, S.
The past, present and future of artificial neural networks in digital games

Bateman, R. M. and Doboli, S.
Reinforcement learning algorithm using neural networks for playing Othello

Liang , Q., Ehlert, P. and Rothkrantz, L.
Towards a neural control artificial pilot

Mańdziuk, J. and Mossakowski, K.
Looking inside neural networks trained to solve double dummy bridge problems

Churchill, J., Cant, R. and Al-Dabass, D.
Using neural network techniques within a Go playing program

Graepel, T., Herbrich, R. and Gold, J.
Learning to fight

REINFORCEMENT LEARNING ALGORITHM USING NEURAL NETWORKS FOR PLAYING OTHELLO

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KEYWORDS
Reinforcement Learning, TD learning, Neural Networks, Othello.

ABSTRACT

THE PAPER PRESENTS A REINFORCEMENT LEARNING ALGORITHM USING NEURAL NETWORKS FOR LEARNING AN AGENT TO PLAY THE OTHELLO GAME. THE SYSTEM HAS NO INITIAL KNOWLEDGE OF THE GAME, EXCEPT OF ITS RULES. REINFORCEMENT LEARNING TECHNIQUES ALLOW AN AGENT TO LEARN SUCCESSFUL GAME STRATEGIES BY REPEATEDLY PLAYING THE GAME. THE ONLY INFORMATION RECEIVED BY THE AGENT DURING LEARNING IS A REINFORCEMENT SIGNAL AT THE END OF EACH GAME. NEURAL NETWORKS ARE KNOWN FOR THEIR GOOD GENERALIZATION FOR UNTRAINED INPUTS. SINCE THE STATE SPACE FOR A GAME LIKE OTHELLO IS VERY LARGE, WE USE NEURAL NETWORKS TO REPRESENT THE VALUE FUNCTION. THE APPROACH IS SIMILAR TO THAT OF TESAURO FOR THE GAME OF BACKGAMMON. THE LEARNED NETWORK CAN PLAY OTHELLO AT A LEVEL CLOSE TO THAT OF EXPERT PROGRAMS AS SHOWN BY ITS PERFORMANCE IN WORLD-CHAMPIONSHIP GAMES.

BIOGRAPHY

Richard M. Bateman graduated with high-honors in 2004 from Hofstra University with a B.S. in Computer Science and minor in English. His current research interests include swarm intelligence, machine learning, and neural networks. Since 2003, he has been a member of Upsilon Pi Epsilon, Honor Society in the Computing Sciences.

Simona Doboli received her Ph.D. in Electrical Engineering at the University of Cincinnati in 2001. She is currently an Assistant Professor in the Computer Science Department at Hofstra University, Hempstead, NY. Her research interests include learning and memory in biologically inspired neural networks,computational models of the hippocampal function.

TOWARDS A NEURAL CONTROL ARTIFICIAL PILOT

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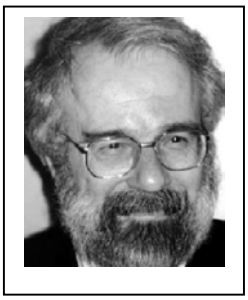
KEYWORDS
Neural control, flight simulator

ABSTRACT
In this paper we will address our efforts to design a neural control system that can control a simulated aircraft, which ultimately should lead to a realistic artificial pilot. The system we designed consists of a flight plan module, the actual neural controller module, and a graphic user interface. The goal of the flight plan module is to manage the global control of the whole system. For the neural controller we chose to use a Forward Modeling and Inverse Controller. The Jordan Network was used to construct the pre-trained identifier and the online learning controller. Our first experiments showed that improvements were necessary to make the aircraft fly more smoothly. Although the aircraft "wobbles" a bit at the start of a new flight procedure, the controller is able to adapt to changing circumstances during flight.

BIOGRAPHY

QUIXIA LIANG recently obtained her Master's degree in Electrical Engineering at the Delft University of Technology, working on neural flight control.

PATRICK EHLERT has obtained his Master's degree in Computer Science at the Delft University of Technology, where he now works as a PhD student on the Intelligent Cockpit Environment (ICE) project.



LEON ROTHKRANTZ has a degree in psychology and mathematics and is working as a lecturer at the Delft University of Technology.

LOOKING INSIDE NEURAL NETWORKS TRAINED TO SOLVE DOUBLE DUMMY BRIDGE PROBLEMS

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KEYWORDS
Bridge, Double Dummy Problem, Artificial Neural Networks, Connection Weights, Knowledge Represenatation

ABSTRACT

Several feed-forward neural networks were trained to solve double dummy bridge problems. The training was solely based on presentation of sample deals and target number of tricks to be taken by a pair of players. No human knowledge of the game of bridge and even no rules of the game were presented. Analysis of connection weights of trained networks reveals some phenomena, which nevertheless can be explained using human knowledge and experience in the game of bridge.

BIOGRAPHY

Jacek Mańdziuk, Ph.D., D.Sc., received his M.Sc. (Honors) and Ph.D. in Applied Mathematics from the Department of Applied Physics and Mathematics, Warsaw University of Technology, Poland in 1989 and 1993, resp. and the D.Sc. degree in Computer Science from the Polish Academy of Sciences in 2000.

He is currently Associate Professor at the WUT and Head of Computer Department in the Warsaw branch of the Mazovian Gas Company in Warsaw.

His research interest include game playing, financial modeling, time series prediction, pattern recognition, optimization, constructive learning/training methods for neural networks.

Dr Mańdziuk is the author or co-author of one book and over 40 scientific papers published in international journals and conference proceedings. He was a PC member of various international conferences, Program Co-Chair of International Workshop on Adaptive Systems in Soft Computing and Life Sciences and served as the referee for several international journals related to computational intelligence. He is the member of International Neural Networks Society.

In the artificial game playing domain he is currently pursuing research in the area of self-learning and self-improving systems, able to learn without providing any human knowledge or experience. His main iterests are devoted to bridge, othello/reversi and give-away-checkers.

Krzysztof Mossakowski received his M.Sc. (Honors) in Computer Science from the Department of Applied Physics and Mathematics, Warsaw University of Technology, Poland in 1999. He is currently Assistent at Faculty of Mathematics and Information Science at Warsaw University of Technology. His research interest include Pattern Recognition, especially Optical Music Recognition and Computational Intelligence. He currently fixes his attention to the problem of create self-learnable bridge playing program.

Tuesday 9th November

Session 9 Keynote Presentation

09.00-10.00 Tuesday 9th November

Session Chair: Dr. Quasim Mehdi, University of Wolverhampton

Microsoft at the Game Developers' Conference: Talking and Listening

Mike Pelton
Developer Platforms Group, Microsoft UK

At the recent Games Developers' Conference, Microsoft outlined its plans for The XNA initiative, and outlined short- and longer-term plans for developer tools, talking too about the future of DirectX. But that was only the first day – the main body of the conference focused on the state of the gaming industry, and future trends, including a look at whether mobile devices will fulfil their potential as a gaming platform. This session will provide an overview of Microsoft's announcements, and will also offer an (inevitably subjective!) insight into the highlights of the event, with a look at the most surprising issues, observations, and discussions.

Session 10 Intelligent Agents 1

Tuesday 9th November 10.00 – 11.30

Session Chair: Professor Leon Rothkrantz,
University of Delft, The Netherlands

Anderson, E.F.
A NPC behaviour definition system for use by programmers and designers

Broekens, J. and DeGroot, D.
Scalable and flexible appraisal models for virtual agents

Hirokazu Notsu, Yoshihiro Okada and Koichi Niijima
Component based approach for emotional behavior of 3D CG characters

Jacobi, D., Anderson, D., von Borries, V., Elmaghraby, A., Kantardzic, M., Ragade, R., Mehdi, Q. H. and Gough, N. E.
Building intelligence in gaming and training simulations

A NPC BEHAVIOUR DEFINITION SYSTEM FOR USE BY PROGRAMMERS AND DESIGNERS

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KEYWORDS
game-bots, behaviour definition, scripting language, virtual machine, mini-language.

ABSTRACT

In this paper we describe ZBL/0, a scripting system for defining NPC (Non Player Character) behaviour in FPS (First Person Shooter) games. ZBL/0 has been used to illustrate the use of scripting systems in computer games in general and the scripting of NPC behaviour in particular in the context of a book on game development ("3D-Spieleprogrammierung". Markt+Technik, 2003). Many novice game designers have clear ideas about how the computer game they imagine should work but have little knowledge – if any – about how their ideas can be implemented. This is why books on game creation (design, programming etc.), as well as all-in-one game creation systems – especially designed for ease of use and intended for an amateur audience – enjoy great popularity. A large proportion of these books however merely present solutions in the form of descriptions and explanations of specific implementations with inadequate explanations of principles. While this may benefit rapid application development it often does not lead to a deeper understanding of the underlying concepts. The understanding of rule-based behaviour definition through simple scripting in computer games and the development of such scripts by programmers and designers is what we aim to address with the ZBL/0 system.

BIOGRAPHY

Eike Anderson holds a BA in Computer Animation and Visualisation from the National Centre for Computer Animation (NCCA, Bournemouth University). He is co-author of the German book "3D-Spieleprogrammierung" (3D game programming) on game development. His research interests are centred on behaviour definition systems for characters in games and animation. He is currently working towards a PhD at the NCCA where he is also lecturing computer programming to computer animation undergraduates.

COMPONENT BASED APPROACH FOR EMOTIONAL BEHAVIOR OF 3D CG CHARACTERS

Hirokazu Notsu[1], Yoshihiro Okada[1,2] and Koichi Niijima[1]
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[2]*Intelligent Cooperation and Control, PRESTO, JST*

KEYWORDS
CG Animation, CG Character, Neural Networks, Emotional Behavior, *IntelligentBox*.

ABSTRACT

At present, behaviors of Non Player Characters (NPCs) in computer games are not satisfactory because they are pre-defined and then very simple. To overcome this problem, Namee, et al. proposed an agent system with emotional model units to create more natural behaviors of NPCs by controlling their actions according to their emotion (Namee and Cunningham 2001). The research purpose of the authors is to propose the software architecture that provides NPCs those have emotional behaviors by combining required primitive functionalities represented as software components. As the first trial to achieve this research purpose, the authors designed the agent system proposed by Namee, et al. using *IntelligentBox*, which is a component based 3D software development system. This paper explains the design of the agent system using *IntelligentBox* and the implementation of its emotional model, i.e., a simple stimulus response model. The authors also describe the validity of the implementation by showing the experiment.

BIOGRAPHY

Hirokazu Notsu received his BSc in Physics from the Kyushu University, Japan, in 2004. Currently, he is a master course student in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include 3D graphics, 3D game AI and information visualization.

Yoshihiro Okada received his bachelor, master and doctoral degrees of Engineering from the Electrical Engineering Department, Faculty of Engineering, Hokkaido University, Japan, in 1988, 1990 and 1993 respectively.

Since April, 2000, he has been an Associate Professor in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include 3D graphics, software architecture, network collaboration technology, human-

Koichi Niijima received the BS degree, the MSc degree, and the PhD degree in Mathematics from the Kyushu University, Japan, in 1967, 1969 and 1977, respectively.

Since 1996, he has been a Professor in the Department of Informatics, Graduate School of Information Science and Electrical Engineering, Kyushu University, Japan. His current research interests include wavelets, in particular lifting wavelets, and their applications to image analysis and signal processing and geometric modeling.

BUILDING INTELLIGENCE IN GAMING AND TRAINING SIMULATIONS

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KEYWORDS
Simulation, Agents, Artificial Intelligence, Game, Particle swarm

ABSTRACT

Current war games and simulations are primarily attrition based, and are centered on the concept of "force on force." They constitute what can be defined as "second generation" war games. So-called "first generation" war games were focused on strategy with the primary concept of "mind on mind." We envision "third generation" war games and battle simulations as concentrating on effects with the primary concept being "system on system." Thus, the third generation systems will incorporate each successive generation and take into account strategy, attrition and effects.

This paper will describe the principal advantages and features that need to be implemented to create a true "third generation" battle simulation and the architectural issues faced when designing and building such a system. Areas of primary concern are doctrine, command and control, allied and coalition warfare, and cascading effects. Effectively addressing the interactive effects of these issues is of critical importance. In order to provide an adaptable and modular system that will accept future modifications and additions with relative ease, we are researching the use of a distributed Multi-Agent System (MAS) that incorporates various artificial intelligence methods.

BIOGRAPHY

Dennis Jacobi. Mr. Jacobi is has over ten years work experience that includes involvement in numerous consulting and software development projects. He has served as project manager for numerous projects including the development of an Intelligent Medical System for the NASA Human Space

Flight Program in cooperation with the University of Louisville. He was the primary architect for that system. He has lead project teams in the development of cutting edge technologies where others had previously failed. His leadership, strong sense of logic and organizational skills focused the team to complete their tasks on-time and on-budget. He is adept at balancing client needs with the expertise of PhD and Masters-level consultants and programmers. Mr. Jacobi holds a B.S. in Management from Indiana University and an M.B.A. from the University of Cincinnati with a concentration in Operations Management. He has co-authored four papers on multi-agent intelligent systems.

Don Anderson. Mr. Anderson has served as a senior technology consultant, project manager and analyst on a wide range of projects. He has been an expert in database and data handling issues for over 22 years. He recently served as a collaborator on a project for developing an Intelligent Medical System for NASA's Human Space Flight Program and as a collaborator on an Air Force project to develop the next generation war game. He also brings extensive knowledge of interface design, program design and architecture. He has also conducted workshops, seminars and training sessions on a variety of technology topics from rapid application development to networking. He is serving as the Vice-Chairman of the Industrial Advisor's Board to the University of Louisville Computer Science Department. He is president of Quantum International Corporation, a founding member of the Intellas Group, as well as one of the founders of Intellas Modeling and Simulation. He holds a Bachelor of Arts degree from the University of New Orleans. He is a member the IEEE Computer Society and ACM. In addition Mr. Anderson has been involved in strategic gaming for over forty years.

Vance von Borries. Mr. von Borries is a recognized authority on recreational war gaming and a respected authority on war-gaming in general. He has designed over 30 war games and contributed or written about many more over a 30-year period. He is perhaps best known earlier for his many designs covering WW II warfare in North Africa and lately for several simulations when taken together reproduce in detail the entire Russo-German campaign in Russia in 1941. Mr. von Borries holds a B.A. in foreign affairs from the University of Virginia and a Masters of Business Administration from Bellarmine University.

Adel Elmaghraby. Dr. Elmaghraby holds a Ph.D. in Electrical and Computer Engineering and an M.S. in Electrical Engineering from the University of Wisconsin- Madison. He has served as a Research Scientist at Carnegie Mellon University Software Engineering Institute on several Department of Defense projects and has also been a Faculty visitor to the Army Research Lab with the manned weapon systems group. He is well published and experienced in the related areas of research. Dr. Elmaghraby is a past chair of the IEEE technical committee on simulation, former Associate Editor of Simulation magazine, the artificial intelligence editor for the ISCA transactions, and on the steering committee of the PADS conference.

Mehmed M. Kantardzic. Dr.Kantardzic holds a B.S. Electrical Engineering, Ph.D. and M.S. in Computer Science from the University of Sarajevo, Sarajevo, Bosnia. Dr. Kantardzic has over 20 years experience and research involving intelligent systems, biomedicine, neural networks, knowledge discovery and extraction, intelligent agents and soft computing. He is also the Director of the Data Mining Laboratory at the University of Louisville. He is the author of several textbooks on Data Mining by Wiley Press.

Rammohan K. Ragade. Dr.Ragade received his Ph.D., Electrical Engineering & Control Science from the Indian Institute of Technology, Kanpur, India and Bachelor of Engineering from the Indian Institute of Science, Bangalore. Dr Ragade has over 30 years experience and research in Object Oriented Software Engineering, Networking and Distributed Systems Design, Simulation modeling, Applied AI/ Expert Systems, C++ and JAVA based applications. Dr. Rammohan Ragade has supervised several game development projects for his software engineering classes, and is currently teaching a course on Distributed Systems, with an emphasis on Agent Technology. He has authored or co-authored several papers in the areas of Expert Systems, game theory applications, and simulation modeling and agent technologies. Dr. Rammohan Ragade's doctoral dissertation work is in the area of differential game theory. He is an IEEE Senior Member and an ACM Member.

Session 11 Intelligent Agents 2

Tuesday 9th November 11.45 – 13.15

Session Chair: Professor Leon Rothkrantz,
University of Delft, The Netherlands

Szarowicz, A. and Francik, J.
Human motion for virtual people

Wen, Z., Mehdi, Q. H. and Gough, N. E.
IAgent: A real time intelligent agent animation toolkit

Yannakakis, G. N and Hallam, J.
Interactive opponents generate interesting games

Davies, N.P., Mehdi, Q.H., Anderson, D., Jacobi, D. and Bornes, V.V.
A review of potential techniques for the creation of intelligent agents in virtual environments

HUMAN MOTION FOR VIRTUAL PEOPLE

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KEYWORDS
Animated avatars, Q-learning, motion prototyping

ABSTRACT

While computer animation is currently widely used to create characters in games, films, and various other applications, techniques such as motion capture and keyframing are still relatively expensive. Automatic acquisition of secondary motion and/or motion prototyping using machine learning might be a solution to this problem. Our paper presents an application of the Q-learning algorithms to generate action sequences for animated characters. The techniques can be used in both deterministic and non-deterministic environments to generate actions which can later be incorporated into more complex animation sequences. The paper presents an application of both deterministic and non-deterministic updates of the Q-learning algorithm to automatic acquisition of motion. Results obtained from the learning system are also compared to human motion and conclusions are drawn.

BIOGRAPHY

Adam Szarowicz
2000, MSc Eng Computer Science, Silesian University of Technology, Poland; 2004, PhD Kingston University. Adam started working on the FreeWill animation project in Nov 2000 and participated in creation of FreeWill v2. Adam's research interests include character animation, machine learning, autonomous agents and UML modelling. Adam has been awarded a number of grants and scholarships including the prestigious ORS award (2001) and a Young Scientists Programme grant (2003). He is currently a lecturer in the School of Maths at Kingston University

Jaroslaw Francik
PhD degree in 1999 from Silesian University of Technolgy, Gliwice, Poland and University of Lille, France. Jarek is a lecturer at the School of Computer Science, Silesian University of Technology in Gliwice, Poland, and he joined the School of Computing and Information Systems at Kingston University in August 2003 as a visiting researcher. He is currently developing algorithms for controlling the motion of animated human characters. His research interests include 3D graphics and animation (especially AI based techniques for character animation), visualisation, software engineering and cryptography.

* Work supported by Europen Comission as a part of Marie-Curie fellowship.

IAGENT: A REAL TIME INTELLIGENT AGENT ANIMATION TOOLKIT

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KEYWORDS
Behavioural animation, Motion control, Emotion, DirectX.

ABSTRACT

This paper describes the design and implementation of IAgent: a real time intelligent agent animation toolkit on a PC platform. The animation system consists of 5 main components, namely environment, perception, behaviours, motion generator and rendering. The intelligent agent in the system is represented as a 3D human-like avatar that has a complex underlying structure with multiple degrees of freedom (DOFs). The agent relies on a fast virtual perception system to capture information from its environment and a behaviours system to determine what actions should be taken. A novel motion generation architecture and animation blending system have been developed to produce non-repetitive behaviours for the intelligent agent based on its momentary goal, internal and emotional states. The proposed system has been implemented in DirectX. Experiments have been carried out using the toolkit and the results have clearly demonstrated that the method produces convincing real time behaviours for a 3D virtual human agent.

BIOGRAPHY

Zhigang Wen currently works as a research fellow in the *eDrama* project at the School of Computer Science, University of Birmingham. His main research interests include real time virtual human animation, gesture generation system and natural language processing for 3D embodied conversational agent.

Quasim Mehdi – see page 7

Norman Gough – see page 7

INTERACTIVE OPPONENTS GENERATE INTERESTING GAMES

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KEYWORDS
On-line Learning in Computer Games, Prey/Predator, Interactive Opponents, Interest Emergence.

ABSTRACT

In this paper we present experiments on neuro-evolution mechanisms applied to predator/prey multi-character computer games. Our test-bed is a computer game where the prey (i.e. player) has to avoid its predators by escaping through an exit without getting killed. By viewing the game from the predators' (i.e. opponents') perspective, we attempt off-line to evolve neural-controlled opponents, whose communication is based on partial implicit information, capable of playing effectively against computer-guided fixed strategy players. However, emergent near-optimal behaviors make the game less interesting to play. We therefore discuss the criteria that make a game interesting and, furthermore, we introduce a generic measure of this category of (i.e. predator/prey) computer games' interest (i.e. player's satisfaction from the game). Given this measure, we present an evolutionary mechanism for opponents that keep learning from a player while playing against it (i.e. on-line) and we demonstrate its efficiency and robustness in increasing and maintaining the game's interest. Computer game opponents following this on-line learning approach show high adaptability to changing player strategies which provides evidence for the approach's effectiveness against human players.

BIOGRAPHY

Georgios N. Yannakakis (Student Member, IEEE) received both the 5-year Diploma (1999) and the M.Sc. (2001) degree from the Technical University of Crete, Chania, Greece. He is a Ph.D. candidate at the School of Informatics, Centre of Intelligent Systems and their Applications, University of Edinburgh. G. Yannakakis is currently a visiting researcher at the Maersk Institute for Production Technology, University of Southern Denmark, Odense. He has published several research papers in the areas of cooperative multi-agent systems, evolutionary computation and AI in computer games.

John Hallam received the B.A. degree in Mathematics from the University of Oxford, UK, in 1979 and the Ph.D. degree in Artificial Intelligence from the University of Edinburgh, UK, in 1985. He is an Associate Professor at the Maersk Institute for Production Technology, University of Southern Denmark, Odense. He was a Senior Lecturer at the Division of Informatics, University of Edinburgh, UK, before joining Maersk Institute. His research interests include biomimetic robotics, evolutionary robotics, connectionist computing, computer vision, and electronic sensors and hardware.

A Review of Potential Techniques for the Creation of Intelligent Agents in Virtual Environments

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KEYWORDS
3D Scene Construction, Computer Graphics, Artificial Intelligence

ABSTRACT

This paper presents a review of potential architectures and tools for the production of Virtual Environments with Integrated Intelligent Characters. Initial research was carried out into the production of a real-time system for the creation of graphically realistic scenes for crime scene reconstruction in Davies et al (2004). The system was capable of rendering scenes produced via a graphical interface, and characters with pre-generated animation sequences could be placed and oriented in the scenes to act out crime events. It is proposed that these characters would be more beneficial if they were endowed with intelligent qualities so they could act in an autonomous manner when presented with a scenario. It is anticipated that this would produce a diverse set of actions and resulting scene disturbance which would be of benefit to forensic crime investigation students, who could theories about the events performed in the scene, and evaluate their responses against the actual events.

BIOGRAPHY

Nicholas Davies is a Ph.D Student at the University of Wolverhampton researching Artificial Intelligence and Graphical Techniques for Virtual Environment Simulation. He holds a Fist Class Hons Degree in Computer Science obtained from the University of Wolverhampton (2003)

Quasim Mehdi – see page 7

Norman Gough – see page 7

Sessions 12 and 13 are parallel sessions

Session 12 AI Tools for Games 1

Tuesday 9th November 14.00 – 15.30

Room A

Session Chair: Dr. Godfried Williams,
University of East London, UK

Fyfe, C.
Independent component analysis against camouflage

Kumar, P., Bottaci, L., Mehdi, Q. H., Gough, N. E. and Natkin, S.
Efficient path finding for 2D games

Macleod, A.
Perudo as a development platform for artificial intelligence

Livingstone, D. and McGlinchey, S. J.
What believability testing can tell us

INDEPENDENT COMPONENT ANALYSIS AGAINST CAMOUFLAGE

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The University of Paisley,
Scotland.
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KEYWORDS: Independent component analysis, intelligence.

.

ABSTRACT We create an artificial game environment in which the signal from a human player can be sensed by an AI in one of 10 sensory channels. However the human can disguise his signal, effectively by splitting the signal between the 10 sensory channels and then corrupting it with high amplitude noise. We show that the technique of Fast Independent Component Analysis can overcome this signal and illustrate a small game in which the human can adapt his camouflage while the AI searches for the hidden signal.

Professor Colin Fyfe is an active researcher in Artificial Neural Networks, Genetic Algorithms, Artificial Immune Systems and Artificial Life having written over 200 refereed papers, several book chapters and three books. He is a member of the Editorial Board of the International Journal of Knowledge-Based Intelligent Engineering Systems and an Associate Editor of International Journal of Neural Systems. He currently supervises 6 PhD students and has acted as Director of Studies for 15 PhDs (all successful) since 1998. 9 former PhD students now hold academic posts including one other Professor and one Senior Lecturer**.** He is a member of the Academic Advisory Board of the International Computer Science Conventions group and is a Committee member of the EU-funded project, EUNITE - the European Network of Excellence on Intelligent Technologies for Smart Adaptive Systems. He has been Visiting Researcher at the University of Strathclyde, 1993-94, at the Riken Institute, Tokyo, 1998 and at the Chinese University of Hong Kong, 2000, Rice University, 2001 and Visiting Professor at the University of Vigo, Spain, the University of Burgos, Spain, the University of Salamanca, Spain and the University of South Australia.

EFFICIENT PATH FINDING FOR 2D GAMES

Pawan Kumar [1] Len Bottaci [1] Quasim Mehdi [2] Norman Gough [2] Stephane Natkin [3]

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KEYWORDS
Path finding, A*, A Star, Path searching, Heuristics

ABSTRACT

In this paper we investigate different methods and algorithms from artificial intelligence that can be used for achieving efficient path finding within games and virtual environments. Path finding is a computationally expensive problem that is solved by searching. We investigate different optimization techniques and further develop techniques which can be incorporated within the existing algorithms to make path finding for 2D static environments faster, computationally less expensive and requiring minimum use of resources.

BIOGRAPHY

Pawan Kumar is a research student at University of Wolverhampton in the area of High Performance Open Platform for Games AI Development. He has a Master of Science degree specializing in Games Programming from University of Hull and in addition he holds engineering degree in Computer Technology from Nagpur University (India). He is currently working on the research project involving the use of Beowulf parallel computing cluster with games AI and graphics engines.

PERUDO AS A DEVELOPMENT PLATFORM FOR ARTIFICIAL INTELLIGENCE

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KEYWORDS

Perudo, Artificial Intelligence, Opponent Modelling, Games.

ABSTRACT

It is proposed that the dice game of Perudo is a more suitable test platform for the development of Artificial Intelligence techniques than traditional perfect information games such as chess. The game and the fundamental principles will be outlined and it is suggested that the unusually high importance of deception makes it impossible for a machine to play expertly without adopting a sophisticated opponent model. A web-based playing system and the development of artificial players with a DLL is described.

WHAT BELIEVABILITY TESTING CAN TELL US

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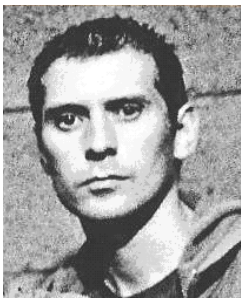
KEYWORDS
Believability, AI Evaluation

ABSTRACT

A number of recent works on AI for computer games have promoted the idea of 'believable' AI as being desirable. That is, AI that fools observers or players into thinking that a human, not a machine, is playing the game or controlling the characters that a player interacts with. This process of testing whether or not game players and/or observers believe that they are interacting with (or watching interactions with) humans not machines we term believability testing. We review this idea of believability and show that, despite some flaws, believability testing can be useful in evaluating and improving AI for computer games.

BIOGRAPHY

Daniel Livingstone currently lectures on, and is a year-leader for, the Computer Game Technology BSc degree program at the University of Paisley. His research interests are broad, with an Artificial Life-based PhD on modeling the evolution of language and a number of recent publications on a range of topics relating to computer games (primarily AI related). He currently holds a grant from the Carnegie Trust for the Universities of Scotland, the focus of which is on learning and adaptive AI for RTS games. He is a member of the BCS, the AAAI and of IGDA.



Stephen McGlinchey received the BSc (Hons) degree in Computing Science in 1996 and the PhD degree in 2000, both from the University of Paisley, where he now lectures on the BSc Computer Games Technology course. His research background in in self-organising neural networks, and his current interests are in applying neural methods to computer games; in particular computer opponents. He is also working on intelligent post-processing of motion-capture data using computational intelligence techniques.

Sessions 12 and 13 are parallel sessions

Session 13 Social/humanities Aspects of Games 1

Tuesday 9th November 14.00 – 15.30

Room B

Session Chair: Dr. Jason Rutter,
University of Manchester, UK

Anderson, D., Arnold, S. E., Jacobi, D., Mehdi, Q. H. and Gough, N. E.
Turning a corner: Games and the social content

da Fonseca, J. B.
Mastermind with an unlimited number of lies as a modeling tool of cognitive processes involved in human justice

Krzywinski, A., Helgesen, A. S. and Chen, W.
Caeneus architecture – an agent for social games

Thawonmas, R., Zhai, Y. and Konno, Y.
Evaluating reputation of online-game players based on incoming chat messages

TURNING A CORNER: GAMES AND THE SOCIAL CONTENT

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Quasim Mehdi[b], Norman Gough[b]
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KEYWORDS
Games, Social Content, Simulation, Modeling, Artificial Intelligence

ABSTRACT

Electronic games have moved to the mainstream. With this change has come a new set of challenges for engineers, developers, and funding entities. Third-generation game warfare goes beyond the reflex-reaction of the first and second-generation games, particularly with regard to warfare. The task today is to blend a data rich environment, near real time updates, and cognitive change within a context. Funding agencies, particularly for government-sponsored projects, require two different approaches to engineering design. The first is the need for architecting so that one or more elements can be easily repurposed. Repurposing means that the cost of developing a function or feature can be spread across multiple event delivery platforms. The second is the need for cost reduction and even cost recovery. The outcome of these two different engineering boundaries is a change in the way second-generation games and third-generation games are planned, constructed, implemented, and repurposed. The outlook for games is more robust than for some other types of applications but the opportunities come with greater costs. Changes include the need for online support, use of game-like functions outside of a game environment on analysts' desktops, and an increased discipline with regard to code, team composition, and engineering tactics.

BIOGRAPHY

Don Anderson. Mr. Anderson has served as a senior technology consultant, project manager and analyst on a wide range of projects. He has been an expert in database and data handling issues for over 22 years. He recently served as a collaborator on a project for developing an Intelligent Medical System for NASA's Human Space Flight Program and as a collaborator on an Air Force project to develop the next generation war game. He also brings extensive knowledge of interface design, program design and architecture. He has also

conducted workshops, seminars and training sessions on a variety of technology topics from rapid application development to networking. He is serving as the Vice-Chairman of the Industrial Advisor's Board to the University of Louisville Computer Science Department. He is president of Quantum International Corporation, a founding member of the Intellas Group, as well as one of the founders of Intellas Modeling and Simulation. He holds a Bachelor of Arts degree from the University of New Orleans. He is a member the IEEE Computer Society and ACM. In addition Mr. Anderson has been involved in strategic gaming for over forty years.

Steve Arnold. Mr. Arnold is a technology and financial analyst with more than 30 years of experience. He is the author of six books and over 50 journal articles, and writes a monthly column about emerging technologies for VNU's London-based Information World Review newspaper. He has provided technical, financial, and strategic support for many technology projects. In 1993, he and a partner started Point (Top 5%) of the Internet, selling that property to Lycos, Inc. in 1996. He has been involved in numerous projects related to Internet technology, including the personalization tools used in the original @Home service. In 2000, he helped develop the plan, architecture, and security guidelines concepts for First-Gov.gov, the official gateway to U.S. governmental information. He remains involved in a range of eGov initiatives. He was a member of the planning team for USWest's electronic yellow pages, and has assisted organizations worldwide with technology strategy related to new products and revenue opportunities. He has provided business strategy services to a company funded by the French government's CNRS, the French government's equivalent of the National Science Foundation. In November 2003, Stephen will receive an award for his contributions to online information from the New York State Library Association.

Dennis Jacobi. Mr. Jacobi is has over ten years work experience that includes involvement in numerous consulting and software development projects. He has served as project manager for numerous projects including the development of an Intelligent Medical System for the NASA Human Space Flight Program in cooperation with the University of Louisville. He was the primary architect for that system. He has lead project teams in the development of cutting edge technologies where others had previously failed. His

leadership, strong sense of logic and organizational skills focused the team to complete their tasks on-time and on-budget. He is adept at balancing client needs with the expertise of PhD and Masters-level consultants and programmers. Mr. Jacobi holds a B.S. in Management from Indiana University and an M.B.A. from the University of Cincinnati with a concentration in Operations Management. He has co-authored four papers on multi-agent intelligent systems.

Mastermind with an Unlimited Number of Lies as a Modeling Tool of Cognitive Processes Involved in Human Justice

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Abstract: In 1986 I made an experiment that consisted in the development of the *Anti-Mind* and *Master Mind with Feedback* programs written in the Basic language. The *Anti-Mind* program simulates a *good* player of the Master Mind game, discovering the secret code defined by the human operator (a sequence of numbers in a pre-defined interval) very quickly. Then I used the algorithm of *Anti-Mind* to help and correct a human operator trying to discover the secret code defined by the computer resulting in the *Master Mind with Feedback*.

Let's take an example to show that in some cases it seems that the computer *thinks* better than the human, and has a higher IQ:

Anti-Mind Program
CPC=Number of Correct Digits in Correct Position
CPI=Number of Correct Digits in Incorrect Position
3 Digits
Interval [0,3]

1. 103 CPC,CPI=1,1
2. 132 CPC,CPI=1,1
3. 120 CPC,CPI=0,2

Enough Information!
Secret code=?

The computer knows that the information is enough and the secret code. And you?

In this paper I will also present a recent development, the algorithm of Anti-Mind with an unlimited number of lies which detects and identifies all the moves that are lies or errors, which is based on the Anti-Mind algorithm, and I will present an example with 6 lies and a secret code with 4 digits varying between 0 and 9. I will discuss, at the light of Cognitive Science, why no human is capable of doing this. Finally I will propose a neural network architecture and a learning algorithm based on a hybrid reinforcement algorithm to model the learning process of a human interacting with Mastermind with Feedback. The Anti-Mind with Lies algorithm seems to be a good departure point to the modeling of human justice and the development of computational aids to help in the process of finding the truth from lots of noisy data and data with lies and training software for lawyers and criminal investigators.

Keywords: Mastermind Game, AI, Cognitive Science, Simulation of Human Behaviour, Human Cognitive Limitations

CAENEUS ARCHITECTURE: AN AGENT ARCHITECTURE FOR SOCIAL GAMES

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KEYWORDS

Agent, Agent Architecture, Social Games, Diplomacy, Explicit Knowledge, Tacit Knowledge, Caeneus Architecture

ABSTRACT

This paper presents an architecture of an agent capable of playing Diplomacy game. The Caeneus Architecture is built up as a three-layer, one-pass, vertical-layered agent. Diplomacy is a strategic board game with great focus on diplomatic negotiations between players. In social games such as Diplomacy the participants relate to two kinds of input: the game system (rules and resources) and the social system (communication among the actors). The lower layers of the Caeneus Architecture deal with the former of these two, while the top layer uses the refined information about the game system to carry out diplomatic negotiations with fellow players. The prototype implementation of Caeneus Architecture is described in this paper with particular emphasis on the modules in the three layers.

BIOGRAPHY

Aleksander Krzywinski: Mater student, currently working on the Caeneus project in PAILAB group at the Department of Information Science and Media Studies, University of Bergen. Norway. Scientific background: Algorithms, computer networks, computer graphics, user interface design, artificial intelligence, gaming and human computer interaction. Areas of interest: Software agent systems, computer games, social games, AI in education, Game AI.

Arne S. Helgesen: Master student, currently working on the Caeneus project in PAILAB group at the Department of Information Science and Media Studies, University of Bergen. Norway. Scientific background and interests: Gaming - construction and deconstruction, Artificial Intelligence Software Agents, AI and Games, Human computer interaction.

Weiqin Chen: Associate Professor at the Department of Information Science and Media Studies, University of Bergen. She received her Ph.D. in 1997 from the Chinese Academy of Sciences, China. From 1998 to 2001, she worked as a research associate at the Department of Knowledge Systems, Institute of Scientific and Industrial Research (ISIR), Osaka University and as a project leader at the SilverEgg Technology Ltd. in Japan. From 2001 to 2002, she worked as a post-doctoral researcher at InterMedia and the Department of Information Science, University of Bergen where she led the pedagogical agent group in DoCTA-NSS, the Norwegian national ICT and learning project. Currently she is an active partner in the EU Network of Excellence Kaleidoscope—technology-enhanced learning. She has been teaching Artificial Intelligent course at both undergraduate and graduate levels. Her research interests are focused on AI in education, software agents, distributed collaborative learning and work, and mobile computing.

EVALUATING REPUTATION OF ONLINE-GAME PLAYERS BASED ON INCOMING CHAT MESSAGES

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KEYWORDS
Reputation Systems, Chat Messages, Massively Multiplayer Online Games, Online Communities.

ABSTRACT

In this paper, we propose an online-game player reputation system that is based on incoming chat messages to each player. The key concepts for implementation of the proposed system are that good players are those who received many chat messages and that good players are those who received chat messages from other good players. The proposed system is tested using computer simulations, in which issues on balance, reliability, and characteristics of different implementation recipes are examined.

BIOGRAPHY

Ruck Thawonmas is currently full professor at the Department of Human and Computer Intelligence, Ritsumeikan University in Japan. Since obtaining D.Eng. in 1994 from Tohoku University in Japan, he has been involved in research on soft computing in government, academia, and the private sector. His current research themes are on applications of artificial intelligence and computational intelligence techniques to interactive entertainment.

Sessions 14 and 15 are parallel sessions

Session 14 AI Tools for Games 2

Tuesday 9th November 16.00 – 17.30

Room A

Session Chair: Dr. Godfried Williams,
University of East London, UK

Leen, G. and Fyfe, C.
An investigation of alternative path planning algorithms: Genetic algorithms, artificial immune systems and ant colony optimisation

Nieuwenhuisen, D., Kamphuis, A., Mooijekind, M. and Overmars, M. H.
Automatic construction of roadmaps for path planning in games

Hartley, T., Mehdi, Q. H. & Gough, N. E.
Using value iteration to solve sequential decision making problems in games

Poster

Cazenave, T.
Monte Carlo real time strategy

AN INVESTIGATION OF ALTERNATIVE PATH PLANNING ALGORITHMS: GENETIC ALGORITHMS, ARTIFICIAL IMMUNE SYSTEMS AND ANT COLONY OPTIMISATION

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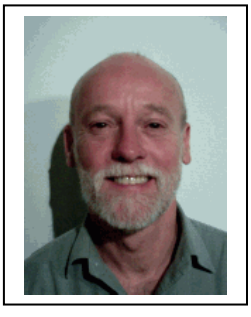
KEYWORDS
Genetic algorithms, artificial immune systems, ant colony optimisation.

ABSTRACT

We investigate the use of three computational intelligence techniques for path planning in computer games. We show that while genetic algorithms and artificial immune systems are effective at finding short useful paths, ant colony methods are much less useful in this task. The Artificial Immune Systems were best in terms of speed and shortness of path found.

BIOGRAPHY

Gayle Leen has just started a Ph.D. in AI and Computer Games at the University of Paisley, and this is her second conference paper. Previous to this, she gained a Masters degree in Electrical and Electronic Engineering from Imperial College, University of London. Her current research interests include learning with probabilistic generative models.



Professor Colin Fyfe is an active researcher in Artificial Neural Networks, Genetic Algorithms, Artificial Immune Systems and Artificial Life having written over 200 refereed papers, several book chapters and three books. He is a member of the Editorial Board of the International Journal of Knowledge-Based Intelligent Engineering Systems and an Associate Editor of International Journal of Neural Systems. He currently supervises 6 PhD students and has acted as Director of Studies for 15 PhDs (all successful) since 1998. 9 former PhD students now hold academic posts including one other Professor and one Senior Lecturer**.** He is a member of the Academic Advisory Board of the International Computer Science Conventions group and is a Committee member of the EU-funded project, EUNITE - the European Network of Excellence on Intelligent Technologies for Smart Adaptive Systems. He has been Visiting Researcher at the University of Strathclyde, 1993-94, at the Riken Institute, Tokyo, 1998 and at the Chinese University of Hong Kong, 2000, Rice University, 2001 and Visiting Professor at the University of Vigo, Spain, the University of Burgos, Spain, the University of Salamanca, Spain and the University of South Australia.

AUTOMATIC CONSTRUCTION OF ROADMAPS FOR PATH PLANNING IN GAMES

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KEYWORDS
Path planning, Roadmap, Probabilistic Roadmap Method, Games, Camera movement, Groups.

ABSTRACT

Path planning plays an important role in many computer games. Currently the motion of entities is often planned using a combination of scripting, grid-search methods, and reactive approaches. In this paper we describe a new approach, based on a technique from robotics, that computes a roadmap of smooth, collision-free, high-quality paths. This roadmap can be used to obtain instantly good paths for entities. We also describe applications of the technique for planning the motion of groups of entities and for creating smooth camera movements through an environment.

BIOGRAPHY

Dennis Nieuwenhuisen completed his master in Computer science in 2002 and now works on his PhD at the computer science department of Utrecht University in the Netherlands. His current research interests include motion planning in changing environments and motion planning using compliance.

Arno Kamphuis completed his master Computational Science in 1999. After working for three years as a software developer, both at the Utrecht University and in industry, he is now a PhD student at the Institute of Information and Computing Sciences of the Utrecht University in the Netherlands. His current research focuses mainly on motion planning for groups of entities in virtual environments, with a particular interest in games as the applications.

Marlies Mooijekind completed her master Computer science in 2004. Her thesis was about creating high quality camera motions for tracking a guide.

Mark Overmars is a full professor in Computer Science at Utrecht University in the Netherlands. Here he heads the Center for Geometry, Imaging, and Virtual Environments (www.give.nl). His main research interests include motion planning, virtual environments, and game design. He is currently prime contractor of the EU-funded MOVIE project (www.give.nl/movie) that focuses on the use of motion planning technology in virtual environment applications, including games.

USING VALUE ITERATION TO SOLVE SEQUENTIAL DECISION PROBLEMS IN GAMES

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KEYWORDS
Value iteration, artificial intelligence (AI), AI in computer games.

ABSTRACT

Solving sequential decision problems in computer games, such as non-player character (NPC) navigation, can be quite a complex task. Current games tend to rely on scripts and finite state machines (FSM) to control AI opponents. These approaches however have shortcomings; as a result academic AI techniques may be a more desirable solution to solve these types of problems. This paper describes the process of applying the value iteration algorithm to an AI engine, which can be applied to a computer game. We also introduce a new stopping criterion called game value iteration, which has been designed for use in 2D real time computer games and we discuss results from experiments conducted on the AI engine. We also outline our conclusions which state that the value iteration and the newly introduced game value iteration algorithms can be successfully applied to intelligent NPC behaviour in computer games; however there are certain problems, such as execution speed, which need to be addressed when dealing with real time games.

BIOGRAPHY

Thomas Hartley is a PhD research student at the University of Wolverhampton in the field of Artificial Intelligence and it currently working on research in the area of learning from observation and computer games. Thomas holds a BSc (Hons) in computer science from the University of Wolverhampton.

Quasim Mehdi see page 7

Norman Gough see page 7

Sessions 14 and 15 are parallel sessions

Session 15 Social/Humanities Aspects of Games 2

Tuesday 9th November 16.00 – 17.30

Room B

Session Chair: Dr. Jason Rutter,
University of Manchester, UK

Thornton, J. S. and Purdy, J. H.
Profiling the physiological and psychological effects of playing a networked 'first person shoot-em-up' computer game: Quantitative descriptive pilot study

Wiklund, M.
Games and peer-to-peer file sharing: Attitudes towards illegal distribution of computer games

PROFILING THE PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF PLAYING A NETWORKED 'FIRST PERSON SHOOT-EM-UP' COMPUTER GAME: QUANTITATIVE DESCRIPTIVE PILOT STUDY

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KEYWORDS
Research, computer games, physiological, psychological, visualization, statistical surfaces.

ABSTRACT

Objectives: To describe the phenomena as they exist by observing the physiological and psychological impact on subjects of playing a networked competition 3 dimensional first person combat computer video game. To develop, trial and refine research methods and measurement techniques. In particular a client server model for delivering online tests and questionnaires and collecting results. To take raw data and summarize it in a useable form by exploiting 3-dimensional (3D) statistical surfaces.
Design & Setting: A 2 day, two session, participant observation study in the post-graduate computer laboratory at The University of Hull. Volunteers were invited to play a networked competition of the successful first person 3 dimensional combat game "Unreal Tournament". Prior to playing subjects completed a personality questionnaire, a test of cognitive function and a questionnaire to measure moment affect. Immediately post game play subjects completed the questionnaire to measure moment affect and the test of cognitive function.
Conclusion: Playing a 3-dimensional 1st person combat game as part of networked competition has a measurable effect on cognitive function and mood, and that changes in mood correlate with personality. A robust client-server model for delivering psychometric tests has been developed that is ready for larger scale trials. Immersive visualization of data is a very useful aid to interpretation.

BIOGRAPHY

Jeremy Thornton has an MB ChB. He is a Family Practitioner taking his PhD in Computer Science part time at the University of Hull. His main area of research is the psycho-physiological impact of video games and using the results to design and predict hit games of the future.

Jon Purdy has a PhD in Applied Physics. He is now a lecturer at Hull University in the Department of Computer Science where he developed the curriculum for, and teaches on, the advanced MSc in Games Programming. Jon is an active researcher publishing papers in medical signal processing and visualization.

GAMES AND PEER-TO-PEER FILE SHARING: ATTITUDES TOWARDS ILLEGAL DISTRIBUTION OF COMPUTER GAMES

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KEYWORDS
Computer games, Peer-to-peer file sharing, Software piracy, Attitudes.

ABSTRACT

As peer-to-peer file sharing is a widespread and user friendly technique ideally suited to distribute illegally produced copies of computer games, the users attitudes towards acquiring games through this medium is of great interest.

To obtain information on the extent to which peer-to-peer file sharing is associated with computer games distribution, and the nature of these associations, an empirical study was conducted. Children from age 10 to age 15 were interviewed about their computer based communication habits and attitudes. To ensure unbiased results, games and games related issues were never brought up by the interviewer.

Results show that the distribution of computer games were *spontaneously* pinpointed by 15.58% of the interview subjects being asked about their peer-to-peer file sharing habits. Younger students showed a significantly more positive attitude towards this activity, while a majority of the older students pointed out negative aspects of acquiring computer games this way. Through the negative quotes given, the concept of empathy with game designers is identified as having potential as a possible counterfactor.

BIOGRAPHY

Mats Wiklund completed his BA degree in computer science in 1994 and a licentiate degree in 1999. He currently teaches computer games developement courses at Stockholm University, working on his PhD thesis in parallel. Current research areas focus on computer games related communication issues, both within games and through other channels regarding games.

Wednesday 10th November

Session 16 Keynote

09.00-10.00 Wednesday 10th November

Session Chair: Professor Stéphane Natkin,
CNAM, Paris

Game design in education

Professor Mark H. Overmars
Institute of Information and Computing Sciences, Utrecht University

GAME DESIGN IN EDUCATION

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KEYWORDS
Game design, Education, Game Maker.

ABSTRACT

Computer games play a very important role in the life of most youth. Games offer many possibilities in education. Various people have studied the use of existing games or specially designed educational games. In this paper we consider the use of game design itself in an educational context, with a focus on high schools. Game design can be used in many different subjects, ranging from languages and arts, to mathematics and computer sciences. We also introduce the *Game Maker* software package that can be used by students to easily create their games.

BIOGRAPHY

Mark Overmars is a full professor in Computer Science at Utrecht University in the Netherlands. Here he heads the Center for Geometry, Imaging, and Virtual Environments (www.give.nl). His main research interests include motion planning, virtual environments, and game design. He is the creator of the *Game Maker* software package for creating computer games (www.gamemaker.nl).

Sessions 17 and 18 are parallel sessions

Session 17 Education for Games Design and Development 1

10.00-11.30 Wednesday 10th November

Room A

Session Chairs: Stuart Slater, University of Wolverhampton, UK and Dr Peter Cowling, Bradford University, UK

Doughty, M.
Computer games development education at university

Livingstone, D. and McMonnies, A.
Is DarkBasic to be considered harmful?

Masuch, M. and Nacke, L.
Power and peril of teaching game programming

COMPUTER GAME DEVELOPMENT EDUCATION AT UNIVERSITY

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KEYWORDS
Games computing, software development

ABSTRACT
This paper articulates some of the challenges for computer game development courses at university level. A typical course development of this type is described. The need to include creative methods alongside more formal software development methodologies as core elements of computer game education is proposed and placed within the context of an industry specific framework. The evolutionary nature of the computer game industry requires that computer game development programs at university should be equally evolutionary and adaptable to change.

BIOGRAPHY

Mark Doughty is Programme Leader of the BSc(Hons) Games Computing award at the University of Lincoln. He has worked on the development of the award since its start in 1998. Mark has gained an honours degree in physics and a masters in software engineering at Sheffield University and Sheffield Polytechnic respectively. His current active research interests include interdisciplinary applications of computer game technologies, novel input channels for computer game control and image processing in diagnostic screening.

IS DARKBASIC TO BE CONSIDERED HARMFUL?

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KEYWORDS
Programming languages, DarkBASIC, Education

ABSTRACT

The use of BASIC to teach programming has long been controversial, and remains so. Modern versions of BASIC allow students to develop skills in structured and even object-oriented programming. DarkBASIC is one such version, which includes procedures and very easy access to DirectX. As such, it can allow students the opportunity to create video game projects with a very low entry barrier. We review DarkBASIC, highlighting a number of particular strengths and weaknesses of the language, and examine whether we can justify its inclusion in a university syllabus.

BIOGRAPHY

Daniel Livingstone currently lectures on, and is a year-leader for, the Computer Game Technology BSc degree program at the University of Paisley. His research interests are broad, with an Artificial Life-based PhD on modeling the evolution of language and a number of recent publications on a range of topics relating to computer games (primarily AI related). He currently holds a grant from the Carnegie Trust for the Universities of Scotland, the focus of which is on learning and adaptive AI for RTS games. He is a member of the BCS, the AAAI and of IGDA.

Alistair McMonnies is a lecturer in computing at the University of Paisley. His current interests are in programming technologies, image processing and information retrieval. Alistair has written books on C++ Data Structures, Visual Basic and Object-Oriented programming. He is a member of the IEE and a chartered engineer.

POWER AND PERIL OF TEACHING GAME PROGRAMMING

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ABSTRACT

This paper reviews the teaching of computer games as an academic subject for students at university level. The benefits, challenges and problems of teaching game design and game programming are investigated and discussed. We present an overview of experiences with two different approaches to game programming, one in Magdeburg, Germany, and one in Dunedin, New Zealand. A comparison and a list of practical advices for lecturers of similar courses concludes the paper.

KEYWORDS

Computer Games, Games Education, Game Design, Game Programming, Computer Science Curriculum, Video Games

BIOGRAPHY

Maic Masuch, PhD in computer animation, graduated at University of Magdeburg, Germany where he is now Germany's first professor for computer games. He has been teaching and researching on computer game programming for six years.
Research focuses on authoring of virtual worlds, user interfaces, audio-only-interfaces and graphics for games, especially real-time non-photorealistic rendering techniques for game engines. He supervised several game-related student projects and works as a game consultant for game development companies and the German ministry of research. In addition, Prof. Masuch is co-founder of Impara, a technology think tank that is developing media systems for playful learning.

Lennart Nacke, Student of computational visualistics at the Otto-von-Guericke University Magdeburg, Germany (Vordiplom 12/02), internship at the University of Otago, Dunedin, New Zealand (09/03-02/04), student research assistant at the Department of Simulation and Graphics, member of the student council of the Department of Computer Science, IGDA student member since 01/04. Experience as a tutor for game design courses in New Zealand and Magdeburg. Research interest lies in game design and game programming.

Sessions 17 and 18 are parallel sessions

Session 18 Learning and Adaptation in Games

10.00-11.30 Wednesday 10th November

Room B

Session Chairs: Pieter Spronck, University of Maastricht, The Netherlands and Dr Johannes Fuernkranz, Technical University of Darmstadt, Germany

Jankovic, L. and Chiong, R. (Invited Paper)
Investigation of strategy dynamics using prisoner's dilemma problem

Björnsson, Y, Hafsteinsson, V., Jóhannsson, Á and Jónsson, E.
Efficient use of reinforcement learning in a computer game

Pfeiffer, M.
Reinforcement learning of strategies for Settlers of Catan

Ponsen, M. and Spronck, P.
Improved adaptive game AI with evolutionary learning

INVESTIGATION OF STRATEGY DYNAMICS USING PRISONER'S DILEMMA PROBLEM

Lubo Jankovic* and Raymond Chiong**

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KEYWORDS
Prisoner's dilemma, game strategy, cellular automata

ABSTRACT

The paper investigates games strategies on the basis of experiments with Prisoner's Dilemma problem. The objective is to determine which strategies have the best chance of winning. Although some strategies, such as tit-for-tat, emerge as better than others in some cases, it appears that there is no overall winning strategy, but that success or failure of individual strategies depends on strategies adopted by a population of opponents. The winning strategy will therefore change dynamically, and will need to be determined while the game in progress. Based on the results of this work, a strategy engine for games development is proposed, and a future development of strategy middleware is discussed.

BIOGRAPHY

Lubo Jankovic obtained his PhD in Mechanical Engineering from the University of Birmingham. He is the founding Director of InteSys Ltd, Honorary Lecturer at the University of Birmingham, Senior Lecturer at the UCE, and Fellow of the Institution of Analysist and Programmers. His research interests are in the field of Science of Complexity and application of its principles to dynamic modelling and analysis of behaviour of complex systems.

Raymond Chiong obtained a First Class Honours BSc degree in Computer Science from Universiti Malaysia Sarawak in 2003, and an MSc in Advanced Computer Science from the University of Birmingham in 2004. His major research interests lie in the area of information and database systems, especially in information security and privacy issues, as well as query optimization. His current research is directed at investigating principles and dynamic behaviours of game theory.

EFFICIENT USE OF REINFORMENT LEARNING IN A COMPUTER GAME

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KEYWORDS
Computer game-playing, Mobile games, Artificial intelligence, Reinforcement learning.

ABSTRACT
Reinforcement learning methods are not yet widely used in computer games, at least not for demanding online learning tasks. This is in part because such methods often require excessive number of training samples before converging. This can be particularly troublesome in mobile game devices where both storage and CPU are limited and valuable resources. In this paper we describe a new AI-based game for mobile phones that we are currently developing. We address some of the main challenges of incorporating efficient on-line reinforcement learning methods into such gaming platforms. Furthermore, we introduce two simple methods for interactively incorporating user feed-back into reinforcement learning. These methods not only have the potential of increasing the entertainment value of games, but they also drastically reduce the number of training episodes needed for the learning to converge. This enhancement made it possible for us to use otherwise standard reinforcement learning as the core part of the learning AI in our game.

BIOGRAPHY

Dr. Yngvi Björnsson is an associate professor at the School of Computer Science, Reykjavik University. He holds a Ph.D. degree in computer science from the University of Alberta, Canada, specializing in AI. Prior to moving to Reykjavik University he was for several years a research scientist with the GAMES group at the University of Alberta working on AI in computer games. His research interests are informed search methods, machine learning, and the application of AI to computer games.

Vignir Hafsteinsson is a computer science student at Reykjavik University. He is interested in both artificial intelligence and computer graphics.

Ársæll Jóhannesson is a computer science student at Reykjavik University. He is interested in both artificial intelligence and computer graphics.

Einar Jónsson is a computer science student at Reykjavik University. He is interested in both artificial intelligence and computer security.

REINFORCEMENT LEARNING OF STRATEGIES FOR SETTLERS OF CATAN

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KEYWORDS
Reinforcement Learning, Self-play, Model Trees, Settlers of Catan.

ABSTRACT

In this paper we study the application of machine learning methods in complex computer games. A combination of hierarchical reinforcement learning and simple heuristics is used to learn strategies for the game Settlers of Catan (© 1995 by Kosmos Verlag, Stuttgart) via self-play. Since existing algorithms for function approximation are not well-suited for problems of this size and complexity, we present a novel use of model trees for state-action value prediction in a sophisticated computer game. Furthermore we demonstrate how a-priori knowledge about the game can reduce the learning time and improve the performance of learning virtual agents. We compare several different learning approaches, and it turns out that, despite the simplicity of the architecture, a combination of learning and built-in knowledge yields strategies that are able to challenge and even beat human players in a complex game like this.

BIOGRAPHY

Michael Pfeiffer is a researcher and PhD student at the Institute for Theoretical Computer Science at Graz University of Technology, Austria. He received his MSc degree in mathematics in 2003 from TU Graz. His main research interests are reinforcement learning and the use of machine learning techniques in computer games.

IMPROVING ADAPTIVE GAME AI WITH EVOLUTIONARY LEARNING
Abstract

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KEYWORDS
Games, artificial intelligence, real-time strategy, dynamic scripting, evolutionary algorithms.

ABSTRACT

Game AI is defined as the decision-making process of computer-controlled opponents in computer games. Adaptive game AI can improve the entertainment provided by computer games, by allowing the computer-controlled opponents to fix automatically weaknesses in the game AI, and to respond to changes in human-player tactics online, i.e., during gameplay. Successful adaptive game AI is based invariably on domain knowledge of the game it is used in. Dynamic scripting is an algorithm that implements adaptive game AI. The domain knowledge used by dynamic scripting is stored in a rulebase with manually designed rules. In this paper we propose the use of an offline evolutionary algorithm to enhance the performance of adaptive game AI, by evolving new domain knowledge. We empirically validate our proposal, using dynamic scripting as adaptive game AI in a real-time-strategy (RTS) game, in three steps: (1) we implement and test dynamic scripting in an RTS game; (2) we use an offline evolutionary algorithm to evolve new tactics that are able to deal with optimised tactics, which dynamic scripting cannot defeat using its original rulebase; (3) we translate the evolved tactics to rules in the rulebase, and test dynamic scripting with the revised rulebase. The empirical validation shows that the revised rulebase yields a significantly improved performance of dynamic scripting compared to the original rulebase. We therefore conclude that offline evolutionary learning can be used to improve the performance of adaptive game AI.

BIOGRAPHY

Marc Ponsen received his Bachelor's Degree in Computer Science in 2001 and his Master's Degree in Computer Science in 2004. He is currently pursuing his Ph.D. title at Lehigh University in Bethlehem Pennsylvania in the United States of America. His current research interests include game AI, machine learning, agent technologies and planning.

Pieter Spronck received his Master's degree in Computer Science cum laude in 1996. He worked as a software engineer and knowledge engineer for several companies and research institutes for 15 years, before joining the IKAT institute of Maastricht University in 2001. In 2005 he will receive his Ph.D. title for his work on Adaptive Game AI. His research interests include game AI, machine learning, knowledge technology, and multi-agent systems. He has authored and co-authored about 30 papers in international journals and conference proceedings.

Sessions 19 and 20 are parallel sessions

Session 19 Education for Games Design and Development 2

11.45-13.15 Wednesday 10th November

Room A

Session Chairs: Dr. Daniel Livingstone (University of Paisley, UK) and Dr Jon Purdy (University of Hull, UK)

APPLYING COMPUTER GAMES CONCEPTS TO TEACH DATABASE ANALYSIS AND DESIGN

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Judith Ramsay, School of Social Sciences, University of Paisley

John Sutherland Moray House School of Education, University of Edinburgh, Edinburgh, EH8 8AQ, Scotland

KEYWORDS

Computer simulation games, database analysis and design, constructivist learning environments, problem-based learning, motivation, engagement, neuroplasticity.

ABSTRACT

The study of database systems is typically core in undergraduate and postgraduate programmes related to computer science and information systems. However, one part of this curriculum that many learners have difficulty with is database analysis and design, an area that is critical to the development of modern information systems. This paper reflects on these difficulties and explores a range of pedagogical issues surrounding the development of a problem-based learning environment based on interactive visualisation and computer games to help overcome these difficulties and help the learner develop the skills necessary to understand and perform database analysis and design effectively. The paper proposes a set of guiding principles upon which the proposed learning environment is being developed.

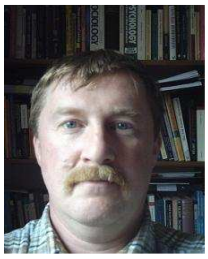
BIOGRAPHY

Thomas M. Connolly is a Professor in the School of Computing at the University of Paisley, having been Head of the Department of Computing and Information Systems for several years. Thomas worked for over 15 years in industry as a Manager and Technical Director in international software houses before returning academia. His specialisms are database systems and online learning. He has developed three fully online MSc programmes and developed and leads the undergraduate BSc Computer Games Technology programme. He is co-author of the highly successful academic textbooks Database Systems (now in its 4th edition) and Database Solutions (in its 2nd edition). He is a reviewer for several international journals and has been on the committee for various international conferences. He is a member of CPHC (Council of Professors and Heads of Computing) and a member of the Higher Education Academy.

Mark Stansfield is a Senior Lecturer in the School of Computing at the University of Paisley. He has a PhD in Information Systems and has published papers on online learning, information systems and e-business in a number of international journals. He is a reviewer for several international journals and has been on the committee for various international conferences.

Evelyn McLellan is a Teaching Fellow in the School of Computing at the University of Paisley. Evelyn is a part-time Ph.D student and her specialisms are designing online programmes and interactive visualisation. She has published several papers in online learning in international conferences and journals.

Judith Ramsay is a Chartered Psychologist. Judith's undergraduate degree and PhD are from the University of Glasgow. Since 1993 she has been working as a research psychologist in the UK and abroad, mainly in industry. Her areas of expertise include the psychology of human-computer interaction and computer-mediated communication. Judith was a Research Assistant for SCROLLA (Scottish Centre for Research into On-Line Learning and Assessment) at the University of Glasgow from 2001 – 2004 before joining the University of Paisley as a Lecturer in Psychology in the School of Social Sciences.



John N. Sutherland splits his time 60:40 as the Reader in Arts and Media at the University of Abertay Dundee, and as a researcher into Higher Education at the University of Edinburgh. In the 1990's he devised the world's first video games degree programmes, and then founded the combined technology/art/music Computer Arts Department at Abertay. Prior to this he was a Visiting Professor in Virtual Reality at Gifu Univeristy in Japan and worked in software development consultancies. His principal interests are in the sociology and anthropology of technology uptake and use.

USING BUGS AND VIRUSES TO TEACH ARTIFICIAL INTELLIGENCE

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KEYWORDS
Games, Teaching, AI, Virus, Terrarium Academic.

ABSTRACT

In this paper we wish to add further to the growing body of evidence that games provide a good platform for teaching advanced computing concepts. We describe our experiences of teaching a group of 45 final year undergraduate students at the University of Bradford in the module "Artificial Intelligence for Games". The students were required to create artificial intelligence for a turn-based board game, Virus, and for a real time artificial life environment, Terrarium Academic. Easy-to-use APIs and sophisticated graphical clients were developed for each game and a server application allowed student AI to compete in a round-the-clock tournament. We describe our experiences in developing and using Virus and Terrarium Academic, focussing particularly on what lessons we have learned that could usefully be applied in other teaching that employs games as a medium of instruction. Student feedback, and the quality of student work, suggests that the module was highly successful in its aims, especially in teaching advanced artificial intelligence and programming ideas to students, some of whom were rather nervous about their ability in both of these areas before starting the module.

BIOGRAPHY

Peter Cowling (http://www.inf.brad.ac.uk/~picowlin) is a Professor of Computing at the University of Bradford. He obtained MA and DPhil degrees from the University of Oxford.He leads the Modelling Optimisation Scheduling And Intelligent Control (MOSAIC) research centre (http://mosaic.ac), whose main research interests lie in the investigation and development of new modelling, optimisation, control and decision support technologies, which bridge the gap between the theory and practice of optimisation, using artificial intelligence and operational research techniques. These approaches have been used in a variety of real world problems involving the planning and scheduling of personnel and production, in collaboration with commercial and industrial partners. He has sat on the programme committees of over 20 international scientific conferences in the past 5 years, and has published over 40 refereed journal and conference papers.

Peter Cowling has been fascinated by games and game AI since his father bought a Commodore Pet computer in the late 1970s. In addition to the work described in this paper, he is currently investigating generic approaches to game tree search in perfect information board games, artificial intelligence for deck construction and game play in collectible card games and learning approaches for real time video game agents.

He lives in the Yorkshire countryside with his wife and three sons.

TEACHING CONSOLE GAMES PROGRAMMING WITH THE SONY PLAYSTATION2 LINUX KIT

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KEYWORDS
Console, Programming, PlayStation2.

ABSTRACT

In May 2002, Sony Computers Entertainment Europe released the PlayStation2 Linux Development Kit providing educational establishments with a means for teaching native code development on this current generation of console. Games console programming is fundamentally different from programming games on PC based platforms and is a valuable skill to be mastered by any graduate seeking employment as a programmer in the Computer Games Industry. In order to obtain optimal performance from a console, detailed knowledge and understanding of the system hardware is required. The PlayStation2 contains several processors which operate in parallel, and both the programming and synchronisation of these processors is essential. Program code is developed for the PlayStation2 Linux Kit using a range of generic and proprietary tools. The GNU C++ compiler is used to create high level game code, an assembler and/or inline assembly is used to create custom high-speed routines, a Vector Command Line preprocessor is used to develop low level code for the Vector Unit processors and the Graphics Synthesiser is configured to render to a television or monitor. These techniques and tools are introduced to students to provide them with a realistic insight into modern console game development.

BIOGRAPHY

Henry Fortuna has a 1st Class Honours Degree in Electrical and Electronic Engineering and a PhD in Solid State Semiconductor Physics. He is a member of the Institution of Electrical Engineers and a Chartered Engineer. He currently teaches on both the BSc and MSc courses in Computer Games Technology at The University of Abertay Dundee. His teaching and development interests are mainly associated with console game programming and DirectX graphics programming. He is actively involved in the PlaySation2 Linux development community and has published tutorials which are shipped with the SPS2 PlayStation2 development environment. He currently maintains a web site (www.hsfortuna.pwp.blueyonder.co.uk) which presents information and tutorials pertinent to games and graphics programming using the PlayStation2 Linux kit.

Sessions 19 and 20 are parallel sessions

Session 20 Learning and Adaptation in Games 2

11.45-13.15 Wednesday 10th November

Room B

Session Chairs: Pieter Spronck, University of Maastricht, The Netherlands and Dr Johannes Fuernkranz, Technical University of Darmstadt, Germany

Tambellini, W, Sanza, C. and Duthen, Y.
High-level decision learning for non-player characters in video games

Thurau, C., Sagerer, G. and Bauckhage, C.
Imitation learning at all levels of game-AI

Fyfe, C. and Wang, T.D.
Cooperative population based incremental learning

Imitation learning at all levels of Game-AI

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KEYWORDS

Gaming, behaviour learning, machine learning, imitation learning, datamining in games, game AI

ABSTRACT

Imitation is a powerful mechanism the human brain applies to extend its repertoire of solutions and behaviours suitable to solve problems of various kinds. From an abstract point of view, the major advantage of this strategy is that it reduces the search space of apropriate solutions. In this contribution, we discuss if and how the principle of imitation learning can facilitate the programing of life-like computer game charecters. We present different algorithms that learn from human generated training data and we show that machine learning can be applied on different levels of cognitive abstraction.

BIOGRAPHY

Christian Thurau received the diploma in computer science from the University of Bielefeld, Germany, in 2003. He joined the research group for Applied Computer Science (Angewandte Informatik) at Bielefeld University, Germany, in 2003, as a PhD student in the graduate program Strategies and Optimisation of Behaviour (GK Verhaltensstrategien & Verhaltensoptimierung).
His research interest lie in the field of machine learning, datamining and behaviour modeling. In particular, he is interested in biologically/psychologically inspired approaches for the modeling of human behaviours in complex environments.

Christian Bauckhage received the diploma and Ph.D. degree (Dr.-Ing.) in computer science from Bielefeld University in 1998 and 2002, respectively. From 1995 to 1996 he took an internship at the Institut National de Recherche en Informatique et en Automatique in Grenoble under the supervision of Cordelia Schmid and Roger Mohr. In 1998 he joined the Applied Computer Science Group at Bielefeld University where until 2002 he used to work within the Collaborative Research Center "Situated Artificial Communicators (SFB 360)" Meanwhile, he is working within the European Union IST project VAMPIRE .
His research interests lie in the fields of computer vision and machine learning. In particular, he is interested in syntactic and structural methods in pattern recognition, texture analysis, episodic memories, and approaches to the evaluation of complex intelligent systems.

Gerhard Sagerer received the diploma and the Ph.D. (Dr.-Ing.) degree in computer science from the University of Erlangen-Nürnberg, Erlangen, Germany, in 1980 and 1985 respectively. In 1990 he received the venia legendi (Habilitation) in computer science from the Technical Faculty of this university.
From 1980 to 1990 he was with the research group for pattern recognition (Institut für Informatik, Mustererkennung) at the University of Erlangen-Nürnberg, Erlangen, Germany. Since 1990 he is a professor of computer science at the University of Bielefeld, Germany, and head of the research group for Applied Computer Science (Angewandte Informatik).
His fields of research are image and speech understanding including artificial intelligence techniques and the application of pattern understanding methods to natural science domains.

COOPERATIVE POPULATION BASED INCREMENTAL LEARNING

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KEYWORDS: Evolution of cooperation, Iterated prisoners' dilemma.

ABSTRACT
We show that cooperation can be evolved in the N-person Iterated Prisoners' Dilemma using the Population Based Incremental Learning Algorithm (PBIL) but that the algorithm often finds a local rather than global optimum. We extend the basic PBIL algorithm in a way which is motivated by a controversial extension to evolutionary theory which considers it possible for the phenotype to manipulate genetic variation when the population meets a paradox which cannot be solved by the current set of phenotypes. We show how this simple extension to the algorithm enables cooperation to be found more reliably.

Professor Colin Fyfe is an active researcher in Artificial Neural Networks, Genetic Algorithms, Artificial Immune Systems and Artificial Life having written over 200 refereed papers, several book chapters and three books. He is a member of the Editorial Board of the International Journal of Knowledge-Based Intelligent Engineering Systems and an Associate Editor of International Journal of Neural Systems. He currently supervises 6 PhD students and has acted as Director of Studies for 15 PhDs (all successful) since 1998. 9 former PhD students now hold academic posts including one other Professor and one Senior Lecturer**.** He is a member of the Academic Advisory Board of the International Computer Science Conventions group and is a Committee member of the EU-funded project, EUNITE - the European Network of Excellence on Intelligent Technologies for Smart Adaptive Systems. He has been Visiting Researcher at the University of Strathclyde, 1993-94, at the Riken Institute, Tokyo, 1998 and at the Chinese University of Hong Kong, 2000, Rice University, 2001 and Visiting Professor at the University of Vigo, Spain, the University of Burgos, Spain, the University of Salamanca, Spain and the University of South Australia.

Assistant professor Tzai-Der Wang is a researcher who majors in Artificial Life, Evolutionary Algorithms, Genetic Algorithms, and Artificial Immune Systems. He is a member of program committee in IWPAAMS 2004 and was the session chair person in conferences CEF 99 and JCIS 2000. He is currently responsible for the information section in the department and holds international research relationship with Applied Computational Intelligence Research Unit of University of Paisley, Scotland and with University of Burgos, Spain. He was supervised by Professor C. Fyfe and graduated from University of Paisley in 2002 with a PhD in the evolution of cooperation in artificial communities.

Sessions 21 and 22 are parallel sessions

Session 21 Student Presentation / Posters

14.00 – 15.00 Wednesday 10th November

Room A

Session Chair: Stuart Slater, University of Wolverhampton, UK

Session 22 European Network of Excellence for Digital Games Research

14.00 – 15.00 Wednesday 10th November

Room B

Session Chairs: Professor Stéphane Natkin, CNAM, Paris, France,
Professor Norman E. Gough and Dr. Quasim Mehdi,
University of Wolverhampton, UK

Session 23 Student Presentation / Posters

15.30 – 16.30 Wednesday 10th November

Session Chair: Stuart Slater, University of Wolverhampton, UK

Session 24 Prizes and Closing

16.30 – 17.00 Wednesday 10th November

Session Chairs: Professor Stéphane Natkin, CNAM, Paris, France,
Professor Norman E. Gough and Dr. Quasim Mehdi,
University of Wolverhampton, UK