

Game Development Essentials Game Artificial Intelligence

Artificial Intelligence and Games AI Game Development Artificial Intelligence for Computer Games General Video Game Artificial Intelligence Game AI Pro Artificial Intelligence Video Games AI for Games Artificial Intelligence for Games Game AI Pro 3 Game Development Essentials Artificial Intelligence for Computer Games Playing Smart Hands-On Artificial Intelligence with Unreal Engine Artificial Intelligence & Games Artificial Intelligence and Games The Psychology of Game AI Game AI Pro 2 Game AI Pro 360: Guide to Character Behavior Game AI Pro 360: Guide to Architecture AI for Games, Third Edition Georgios N. Yannakakis Alex J. Champandard John David Funge Diego Pérez Liébana Steven Rabin Fouad Sabry Ian Millington Ian Millington Steve Rabin John Ahlquist Pedro Antonio González-Calero Julian Togelius Francesco Sapio Georgi Togeli Georgios N. Yannakakis Brian Schwab Steven Rabin Steve Rabin Steve Rabin Ian Millington

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this is the first textbook dedicated to explaining how artificial intelligence ai techniques can be used in and for games after introductory chapters that explain the background and key techniques in ai and games the authors explain how to use ai to play games to generate content for games and to model players the book will be suitable for undergraduate and graduate courses in games artificial intelligence design human computer interaction and computational intelligence and also for self study by industrial game developers and practitioners the authors have

developed a website gameaibook.org that complements the material covered in the book with up to date exercises lecture slides and reading

with game players expecting greater intelligence efficiency and realism with non player characters ai plays an ever increasing important role in game development this is a tremendous challenge for game developers in methodology software design and programming creating autonomous synthetic creatures that can adapt in games requires a different kind of understanding of ai than the classical approach used by current game programmers the nouvelle game ai approach presented in this book focuses on creating embodied animats that behave in an intelligent and realistic manner in particular learning ai is generating much interest among the game development community as these modern techniques can be used to optimize the development process book jacket

learn to make games that are more fun and engaging building on fundamental principles of artificial intelligence funge explains how to create non player characters npcs with progressively more sophisticated capabilities starting with the basic capability of acting in the game world the book explains how to develop npcs who can perceive remem

research on general video game playing aims at designing agents or content generators that can perform well in multiple video games possibly without knowing the game in advance and with little to no specific domain knowledge the general video game ai framework and competition propose a challenge in which researchers can test their favorite ai methods with a potentially infinite number of games created using the video game description language the open source framework has been used since 2014 for running a challenge competitors around the globe submit their best approaches that aim to generalize well across games additionally the framework has been used in ai modules by many higher education institutions as assignments or as proposed projects for final year undergraduate and master s students and ph d candidates the present book written by the developers and organizers of the framework presents the most interesting highlights of the research performed by the authors during these years in this domain it showcases work on methods to play the games generators of content and video game optimization it also outlines potential further work in an area that offers multiple research directions for the future

successful games merge art and technology in truly unique ways fused under tight production deadlines and strict performance requirements shaped by demanding player expectations games are among the most complex software projects created today game ai pro collected wisdom of game ai professionals covers both the art and

the technology of game ai nothing covered is theory or guesswork the book brings together the accumulated wisdom cutting edge ideas and clever tricks and techniques of 54 of today s top game ai professionals some chapters present techniques that have been developed and passed down within the community for years while others discuss the most exciting new research and ideas from today s most innovative games the book includes core algorithms that you ll need to succeed such as behavior trees utility theory spatial representation path planning motion control and tactical reasoning it also describes tricks and techniques that will truly bring your game to life including perception systems social modeling smart camera systems player prediction and even an ai sound designer throughout the book discusses the optimizations and performance enhancements that enable your game to run while maintaining 60 frames per second

what is artificial intelligence video games artificial intelligence ai is used in video games to develop responsive adaptive or intelligent behaviors primarily in non player characters npcs that are akin to the intellect of humans since the beginning of the video game industry in the 1950s artificial intelligence has been an essential component of the medium artificial intelligence ai in video games is a discrete topic that is distinct from ai in academic settings rather than serving the purposes of machine learning or decision making it is designed to enhance the experience of game players the concept of artificial intelligence ai opponents became very popular during the golden age of arcade video games this concept manifested itself in the form of graduated difficulty levels distinct movement patterns and in game events that were reliant on the player s input the behavior of non player characters npcs in modern games is frequently governed by tried and true methods such as pathfinding and decision trees data mining and procedural content production are two examples of ai applications that are frequently utilized in methods that are not immediately obvious to the user how you will benefit i insights and validations about the following topics chapter 1 artificial intelligence in video games chapter 2 artificial intelligence chapter 3 list of artificial intelligence projects chapter 4 video game programmer chapter 5 interactive storytelling chapter 6 outline of video games chapter 7 outline of artificial intelligence chapter 8 general game playing chapter 9 dynamic game difficulty balancing chapter 10 machine learning in video games ii answering the public top questions about artificial intelligence video games iii real world examples for the usage of artificial intelligence video games in many fields iv 17 appendices to explain briefly 266 emerging technologies in each industry to have 360 degree full understanding of artificial intelligence video games technologies who this book is for professionals undergraduate and graduate students enthusiasts

hobbyists and those who want to go beyond basic knowledge or information for any kind of artificial intelligence video games

what is artificial intelligence how is artificial intelligence used in game development game development lives in its own technical world it has its own idioms skills and challenges that is one of the reasons games are so much fun to work on each game has its own rules its own aesthetic and its own trade offs and the hardware it will run on keeps changing ai for games is designed to help you understand one element of game development artificial intelligence ai

creating robust artificial intelligence is one of the greatest challenges for game developers yet the commercial success of a game is often dependent upon the quality of the ai in this book ian millington brings extensive professional experience to the problem of improving the quality of ai in games he describes numerous examples from real games and explores the underlying ideas through detailed case studies he goes further to introduce many techniques little used by developers today the book's associated web site contains a library of c source code and demonstration programs and a complete commercial source code library of ai algorithms and techniques artificial intelligence for games 2nd edition will be highly useful to academics teaching courses on game ai in that it includes exercises with each chapter it will also include new and expanded coverage of the following ai oriented gameplay behavior driven ai casual games puzzle games key features the first comprehensive professional tutorial and reference to implement true ai in games written by an engineer with extensive industry experience walks through the entire development process from beginning to end includes examples from over 100 real games 10 in depth case studies and web site with sample code

game ai pro3 collected wisdom of game ai professionals presents state of the art tips tricks and techniques drawn from developers of shipped commercial games as well as some of the best known academics in the field this book acts as a toolbox of proven techniques coupled with the newest advances in game ai these techniques can be applied to almost any game and include topics such as behavior trees utility theory path planning character behavior and tactical reasoning key features contains 42 chapters from 50 of the game industry's top developers and researchers provides real life case studies of game ai in published commercial games covers a wide range of ai in games with topics applicable to almost any game includes downloadable demos and or source code available at gameai pro com section editors neil kirby general wisdom alex champandard architecture nathan sturtevant movement and pathfinding damian isla character behavior kevin dill tactics

and strategy odds and ends

the book presents some of the most relevant results from academia in the area of artificial intelligence for games it emphasizes well theoretically supported work supported by developed prototypes which should lead into integration of academic ai techniques into current electronic entertainment games the book elaborates on the main results produced in academia within the last 10 years regarding all aspects of artificial intelligence for games including pathfinding decision making and learning a general theme of the book is the coverage of techniques for facilitating the construction of flexible not prescribed ai for agents in games regarding pathfinding the book includes new techniques for implementing real time search methods that improve the results obtained through ai as well as techniques for learning pathfinding behavior by observing actual players regarding decision making the book describes new techniques for authoring tools that facilitate the construction by game designers typically nonprogrammers of behavior controlling software by reusing patterns or actual cases of past behavior additionally the book will cover a number of approaches proposed for extending the essentially pre scripted nature of current commercial videogames ai into a more interactive form of narrative where the story emerges from the interaction with the player some of those approaches rely on a layered architecture for the character ai including beliefs intentions and emotions taking ideas from research on agent systems the book also includes chapters on techniques for automatically or semiautomatically learning complex behavior from recorded traces of human or automatic players using different combinations of reinforcement learning case based reasoning neural networks and genetic algorithms

a new vision of the future of games and game design enabled by ai can games measure intelligence how will artificial intelligence inform games of the future in playing smart julian togelius explores the connections between games and intelligence to offer a new vision of future games and game design video games already depend on ai we use games to test ai algorithms challenge our thinking and better understand both natural and artificial intelligence in the future togelius argues game designers will be able to create smarter games that make us smarter in turn applying advanced ai to help design games in this book he tells us how games are the past present and future of artificial intelligence in 1948 alan turing one of the founding fathers of computer science and artificial intelligence handwrote a program for chess today we have ibm s deep blue and deepmind s alphago and huge efforts go into developing ai that can play such arcade games as pac man programmers continue to use games to test and develop ai creating new benchmarks for ai while also challenging human

assumptions and cognitive abilities game design is at heart a cognitive science togelius reminds us when we play or design a game we plan think spatially make predictions move and assess ourselves and our performance by studying how we play and design games togelius writes we can better understand how humans and machines think ai can do more for game design than providing a skillful opponent we can harness it to build game playing and game designing ai agents enabling a new generation of ai augmented games with ai we can explore new frontiers in learning and play

unreal engine is a powerful game development engine that provides rich functionalities to create 2d and 3d games if you want to use ai to extend the play life of your games and make them more challenging and fun this book is for you it will help you break down ai into simple concepts to give you a fundamental understanding of each of the topics

as has been pointed out by several industrial game ai developers the lack of behavioral modularity across games and in game tasks is detrimental for the development of high quality ai 605 171 an increasingly popular method for ad hoc behavior authoring that eliminates the modularity limitations of fsms and bts is the utility based ai approach which can be used for the design of control and decision making systems in games 425 557 following this approach instances in the game get assigned a particular utility function that gives a value for the importance of the particular instance 10 169 for instance the importance of an enemy being present at a particular distance or the importance of an agent s health being low in this particular context given the set of all utilities available to an agent and all the options it has utility based ai decides which is the most important option it should consider at this moment 426 the utility based approach is grounded in the utility theory of economics and is based on utility function design the approach is similar to the design of membership functions in a fuzzy set a utility can measure anything from observable objective data e g enemy health to subjective notions such as emotions mood and threat the various utilities about possible actions or decisions can be aggregated into linear or non linear formulas and guide the agent to take decisions based on the aggregated utility the utility values can be checked every n frames of the game so while fsms and bts would examine one decision at a time utility based ai architectures

this book covers artificial intelligence methods applied to games both in research and game development it is aimed at graduate students researchers game developers and readers with a technical background interested in the intersection of ai and games the book covers a range of ai methods from traditional search planning and optimization to modern machine learning methods including

diffusion models and large language models it discusses applications to playing games generating content and modeling players including use cases such as level generation game testing intelligent non player characters player retention player experience analysis and game adaptation it also covers the use of games including video games to test and benchmark ai algorithms the book is informed by decades of research and practice in the field and combines insights into game design with deep technical knowledge from the authors who have pioneered many of the methods and approaches used in the field this second edition of the 2018 textbook captures significant developments in ai and gaming over the past 7 years incorporating advancements in computer vision reinforcement learning deep learning and the emergence of transformer based large language models and generative ai the book has been reorganized to provide an updated overview of ai in games with separate sections dedicated to ai s core uses in playing and generating games and modeling their players along with a new chapter on ethical considerations aimed at readers with foundational ai knowledge the book primarily targets three audiences graduate or advanced undergraduate students pursuing careers in game ai ai researchers and educators seeking teaching resources and game programmers interested in creative ai applications the text is complemented by a website featuring exercises lecture slides and additional educational materials suitable for undergraduate and graduate courses

as the video game industry becomes more and more sophisticated designers find that players are assessing ai behavior with increasingly humanistic eyes why do some games seem better than others even if they re not doing anything more complex why do some games feel more real than others why are certain people attracted to certain game genres and is there any way that we can expand the audience for our games these are all questions that require a strong understanding of the psychological issues surrounding games gameplay game ai and the decisions we make in designing our games the psychology of game ai explores the psychological foundations of people with respect to game playing as well as some crucially important human quirks every designer should be aware of in their quest to craft ever more compelling and realistic games

game ai pro2 collected wisdom of game ai professionals presents cutting edge tips tricks and techniques for artificial intelligence ai in games drawn from developers of shipped commercial games as well as some of the best known academics in the field it contains knowledge advice hard earned wisdom and insights gathered from across the com

steve rabin s game ai pro 360 guide to character behavior gathers all the cutting edge information from his previous three game ai

pro volumes into a convenient single source anthology that covers character behavior in game ai this volume is complete with articles by leading game ai programmers that focus on individual ai behavior such as character interactions modelling knowledge efficient simulation difficulty balancing and making decisions with case studies from both commercial and indie games key features provides real life case studies of game ai in published commercial games material by top developers and researchers in game ai downloadable demos and or source code available online

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ai is an integral part of every video game this book helps professionals keep up with the constantly evolving technological advances in the fast growing game industry and equips students with up to date information they need to jumpstart their careers this revised and updated third edition includes new techniques algorithms data structures and representations needed to create powerful ai in games key features a comprehensive professional tutorial and reference to implement true ai in games includes new exercises so readers can test their comprehension and understanding of the concepts and practices presented revised and updated to cover new techniques and advances in ai walks the reader through the entire game ai development process

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Introduction

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