

GO•LEM – AN AUTOMATON OR ROBOT.

GOLEM

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DOTA 2

WHAT IS IT?

Dota 2 is a free-to-play multiplayer online battle arena (MOBA) video game developed and published by Valve Corporation.

Dota 2 is played in matches between two teams that consist of five players. Each of the ten players independently control a powerful character, known as a “hero”, that each feature unique abilities and different styles of play.

During a match, a player and their team collects experience points and items for their heroes in order to fight through the opposing team's defenses.

A team wins by being the first to destroy a large structure located in the opposing team's base, called the “Ancient”.

MECHANICS IN DOTA

THE MAJOR BUILDING BLOCKS OF A GAME

- Abilities
- Damage Types
- Item Builds
- Experience
- Runes
- Fog of War
- Summons
- Courier



DOTA 2 GAMEPLAY

GAMEPLAY



GOLEM

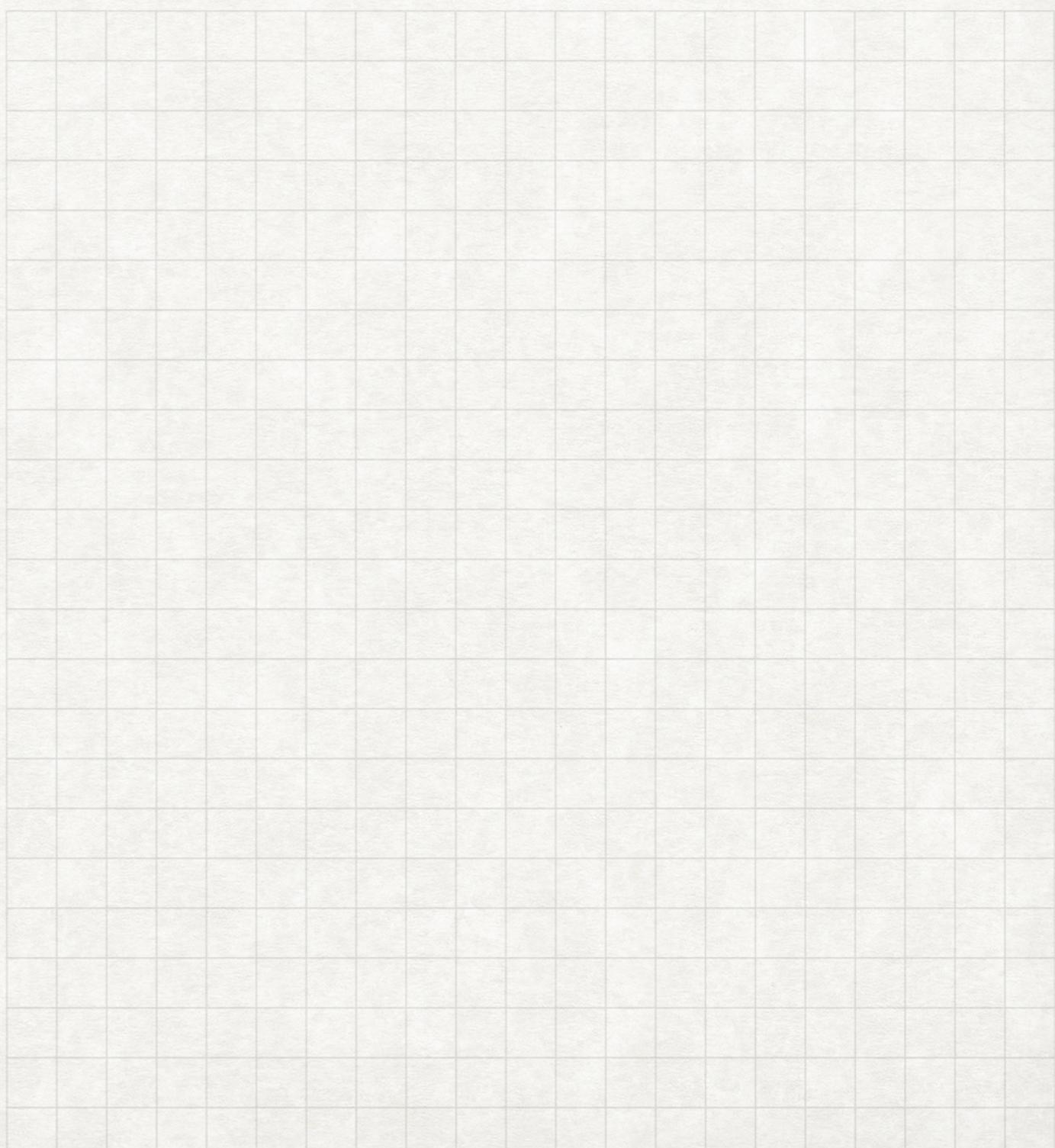
INTRODUCTION

- Golem is a machine learning implementation that uses multiple algorithms to read-in game entities and and interprets actions.
- Use machine learning to learn your play-style and decisions.
- The game data is saved in a Google's Protocol Buffers format, which is decoded to read the game data and the players decisions and movements in-game. A large number of test-cases are obtained and is passed into the appropriate machine learning algorithms — which learn how the player makes decisions based on the current in-game scenario.
- After n leaning data are parsed by machine learning algorithms, a bot is created which constantly sends the current in-game scenario to the machine learning system as parameters, which then replies with the appropriate action taken by the player.

MACHINE LEARNING ALGORITHMS

MAJOR ALGORITHMS USED IN ML

- Linear Regression
- Decision Tree
- Artificial Neural Network



“
BUT THE WORST ENEMY
YOU CAN MEET WILL
ALWAYS BE YOURSELF...”

— *Friedrich Nietzsche*

”

EXISTING SYSTEM

THE CURRENT BOT SYSTEM

- Currently the bots are coded manually for every scenario of the game.
- Due to the high complexity of the game it is cumbersome to code bots of every scenario in the game.
- As Dota is a team oriented game, it is further a challenging task to code bots that interact with each other to achieve specific goals.

ADVANTAGES

- **Anti-cheat** - Machine learning can understand how a human plays a game and can detect when a non-human entity is used to cheat.
- **Bot Automation in other fields** - Machine learning bot creation implementation can be used to create bots for other fields with similar requirements.
- **Understanding human decision making and patterns** - Can be used to further many fields in human-machine interaction and create more human-like bots.

DISADVANTAGES

- Learning Data - Machine learning needs hundreds to thousands of training data to create a good map of which action to take based on the scenario.

DOMAIN AND TECHNOLOGY

TECHNOLOGIES USED IN GOLEM

- TensorFlow - An open-source software library for Machine Intelligence
- Google's Protocol Buffers - Protocol Buffers are a language-neutral, platform-neutral extensible mechanism for serializing structured data.
- Manta - Manta is a low-level Protocol Buffer parser.
- Google's Go (GoLang) - Go is a free and open source programming language created at Google in 2007.
- Python - Python is a widely used high-level programming language for general-purpose programming, first released in 1991.
- Lua - Lua is a powerful, efficient, lightweight, embeddable scripting language.
- LuaSocket - Network support for the Lua language.
- SQL - Structured Query Language is used to communicate with a database.

MODULES

1. Protocol Buffers Parsing.
2. Organizing Data
3. Implementing Machine Learning Algorithms
4. Reading in-game entities using Lua networks
5. Creating bots in-game which mimic play-style with actions obtained from TensorFlow.

WORK LOAD DISTRIBUTION

- Protocol Buffer Parsing - Aksharadeep H.R, Anselm Joseph and Anshul Sinha.
- Lua / Reading and Scripting bots - Anurag Kalangi.
- SQL Design and Implementation - Aksharadeep H.R and Anurag Kalangi.
- TensorFlow / Machine Learning - Anselm Joseph and Anshul Sinha.
- LuaSocket Networking - Anselm Joseph and Anshul Sinha.
- Documentation - Aksharadeep H.R and Anurag Kalangi.