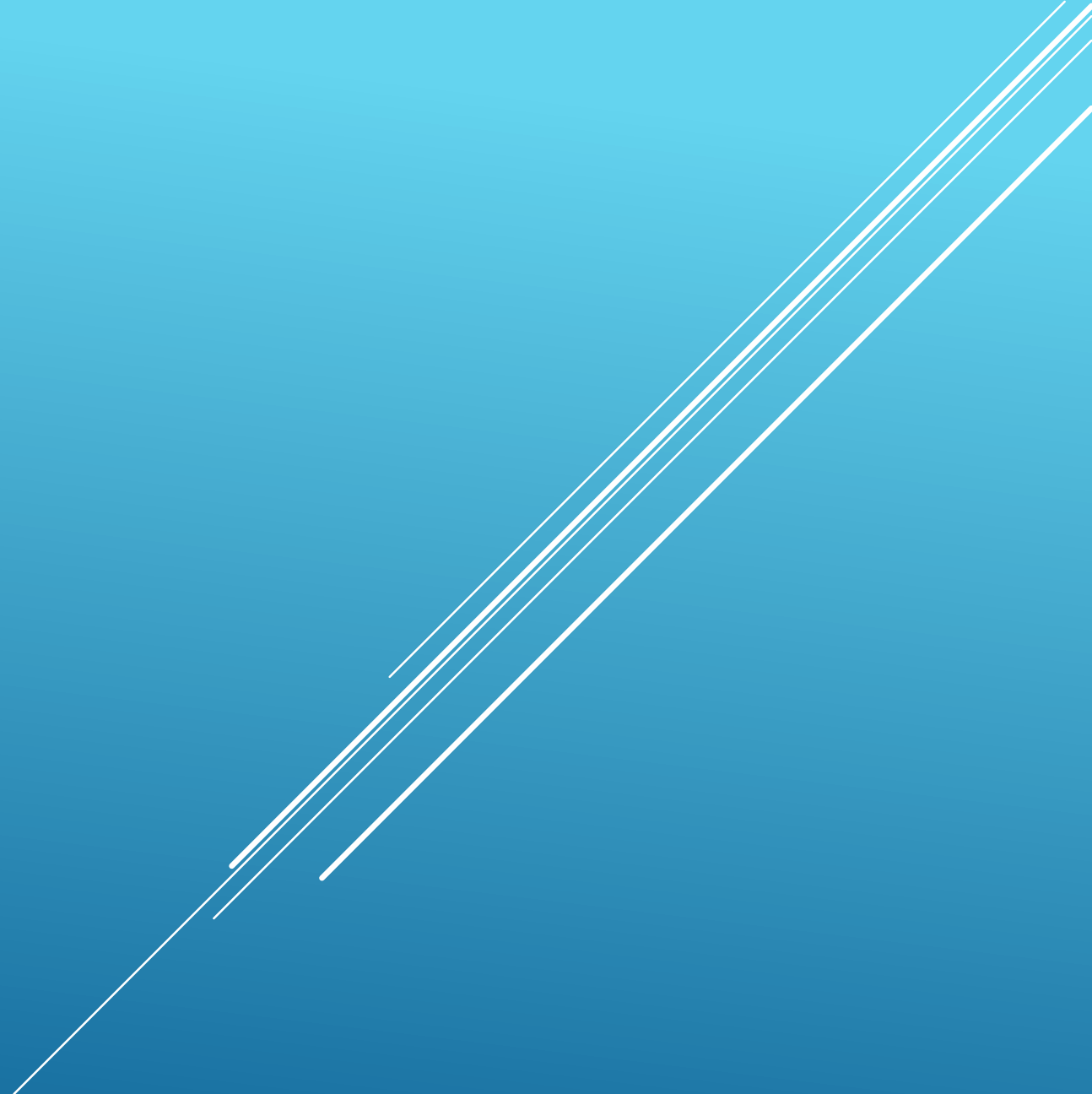


REINFORCEMENT LEARNING IN STARCRRAFT 2

Björn Boyd Isacsson



- ▶ When is it used
- ▶ Improvement needed
 - ▶ Players are too good
 - ▶ Difficult and time-consuming creation
 - ▶ General only

AI IN GAMES

A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

- ▶ Why?
- ▶ What is StarCraft 2?
- ▶ AI in StarCraft
 - ▶ Default
 - ▶ Human-made
- ▶ Galaxy Script



STARCRRAFT 2

- ▶ Why?
 - ▶ Games
 - ▶ Galaxy limitations
- ▶ What is Reinforcement Learning?

REINFORCEMENT LEARNING



- ▶ States and Actions
- ▶ Reward-based
- ▶ Iterations
- ▶ Optimisation vs Exploration

- ▶ Put it all together!
 - ▶ Problems?

REINFORCEMENT LEARNING THE BASICS



- ▶ Continuous gameplay
 - ▶ Sampling
- ▶ Lots of actions
 - ▶ Limiting the actions
- ▶ “Infinite” states
 - ▶ Table → Function
 - ▶ $Q[s][a] \rightarrow Q(s, a) = a + \beta * x_1 + \gamma * x_2 + \dots$
 - ▶ Find values for $\alpha, \beta, \gamma \dots$

REINFORCEMENT LEARNING FIXING THE PROBLEMS

- ▶ Sample time
 - ▶ 0.1 seconds
- ▶ Actions
 - ▶ Move left
 - ▶ Move right
 - ▶ Attack closest target
- ▶ Function
 - ▶ Distance
 - ▶ Reinforcement Learning AI Health
 - ▶ Enemy Health
 - ▶ Action chosen

THE AI IMPLEMENTATION



MY OPTIMAL



Learning completed. Looping best found technique.
Learning completed. Looping best found technique.

ONE UNIT – 10 ITERATIONS



ONE UNIT – 100 ITERATIONS

- ▶ Implementing many units
 - ▶ One AI
 - ▶ Multiple AIs

MANY UNITS

A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.



MANY UNITS – 100 ITERATIONS

MANY UNITS – 1000 ITERATIONS

The image features a solid blue background with a gradient from light blue at the top to a darker blue at the bottom. In the bottom right corner, there are several white, parallel diagonal lines of varying lengths and positions, creating a sense of motion or a stylized graphic element.

- ▶ Reinforcement Learning
 - ▶ Requires instant reward
 - ▶ Many iterations = Lots of time
 - ▶ No guaranteed optimal
- ▶ Galaxy Script
 - ▶ Memory!

LIMITATIONS

- ▶ There is potential
- ▶ Improvements could expand the possibilities
- ▶ Doesn't fit every scenario

CONCLUSION