

# Artificial Intelligence in Java

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A vertical decorative image on the left side of the slide. It features a large, white, layered paper sculpture of a landscape. At the top is a large, smooth sphere, possibly representing a moon or a sun. Below it are jagged, layered mountain peaks. The base of the sculpture is composed of many thin, overlapping layers of paper, creating a sense of depth and texture. The background of the image is a soft, light gray with subtle gradients.

# Why Learn Artificial Intelligence?

Artificial Intelligence (**AI**) covers a range of powerful **methods** and **tools**

Includes **techniques** like **machine learning** and **neural networks**

Also supports **optimization problems** and **graph-based algorithms**

**Examples:** gradient descent,  $A^*$  search, genetic algorithms, and more

These algorithms are practical and widely applicable across domains

# AI in Robotics and Navigation

Robotics often requires movement in **unknown environments**.

Example: **exploration robots on Mars** need shortest path algorithms

- **A\* search** and **depth-first search** are especially helpful

Similar techniques are used in **video games** for pathfinding

- Games use **A\* search** for **player movement** on **2D maps**





# Optimization Problems and AI



## Problem Complexity

Many optimization problems are **extremely hard** to solve exactly



## Classic Examples

Examples: **Traveling Salesman Problem**, **circulation problem**



## Exponential Growth

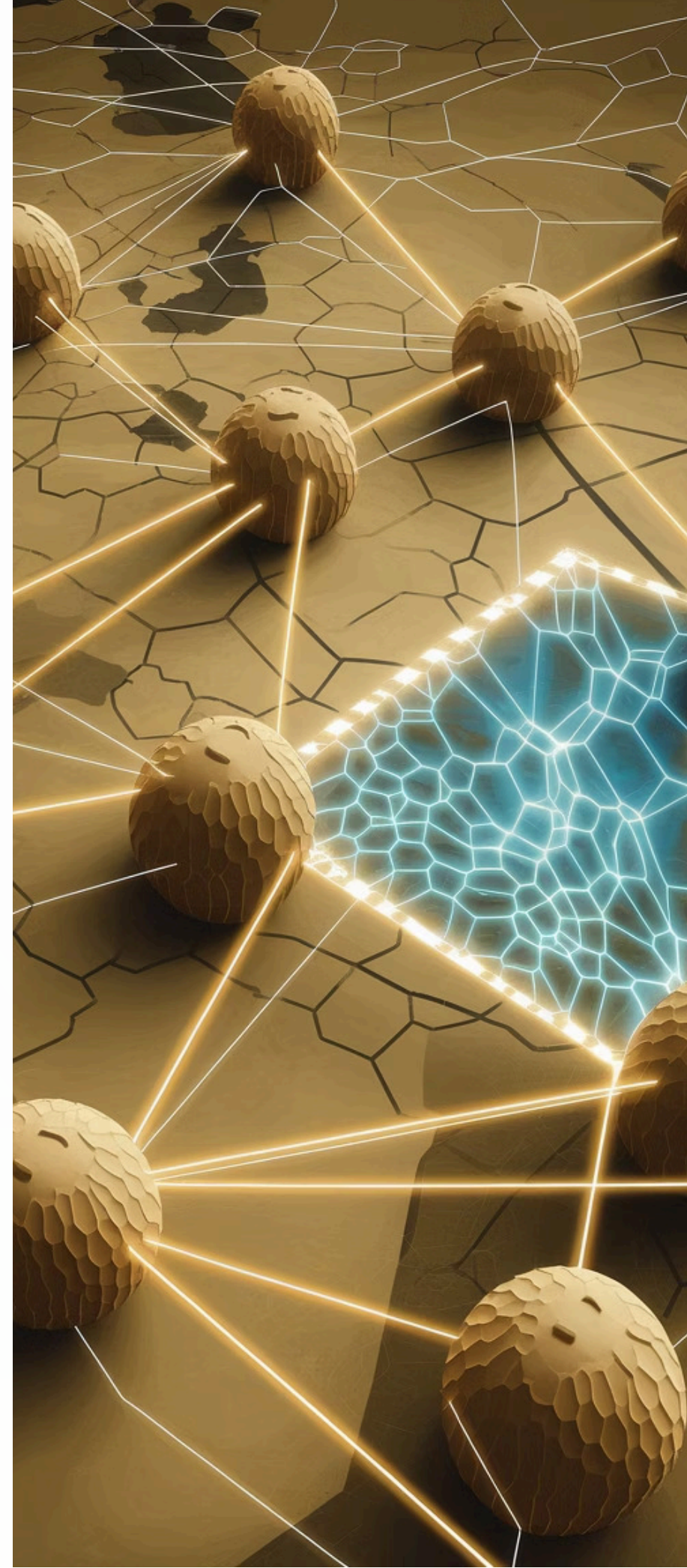
**Search space** grows **exponentially**, making traditional techniques slow



## Solution Approach

**Approximate solutions** become necessary for performance

- Use of **genetic algorithms** and **simulated annealing**





# Metaheuristic Algorithms in AI

## Complex Problem Solving

**Metaheuristic algorithms** handle complex, large-scale problems

## Genetic Algorithms

**Genetic algorithms** evolve solutions using principles from biology

## Simulated Annealing

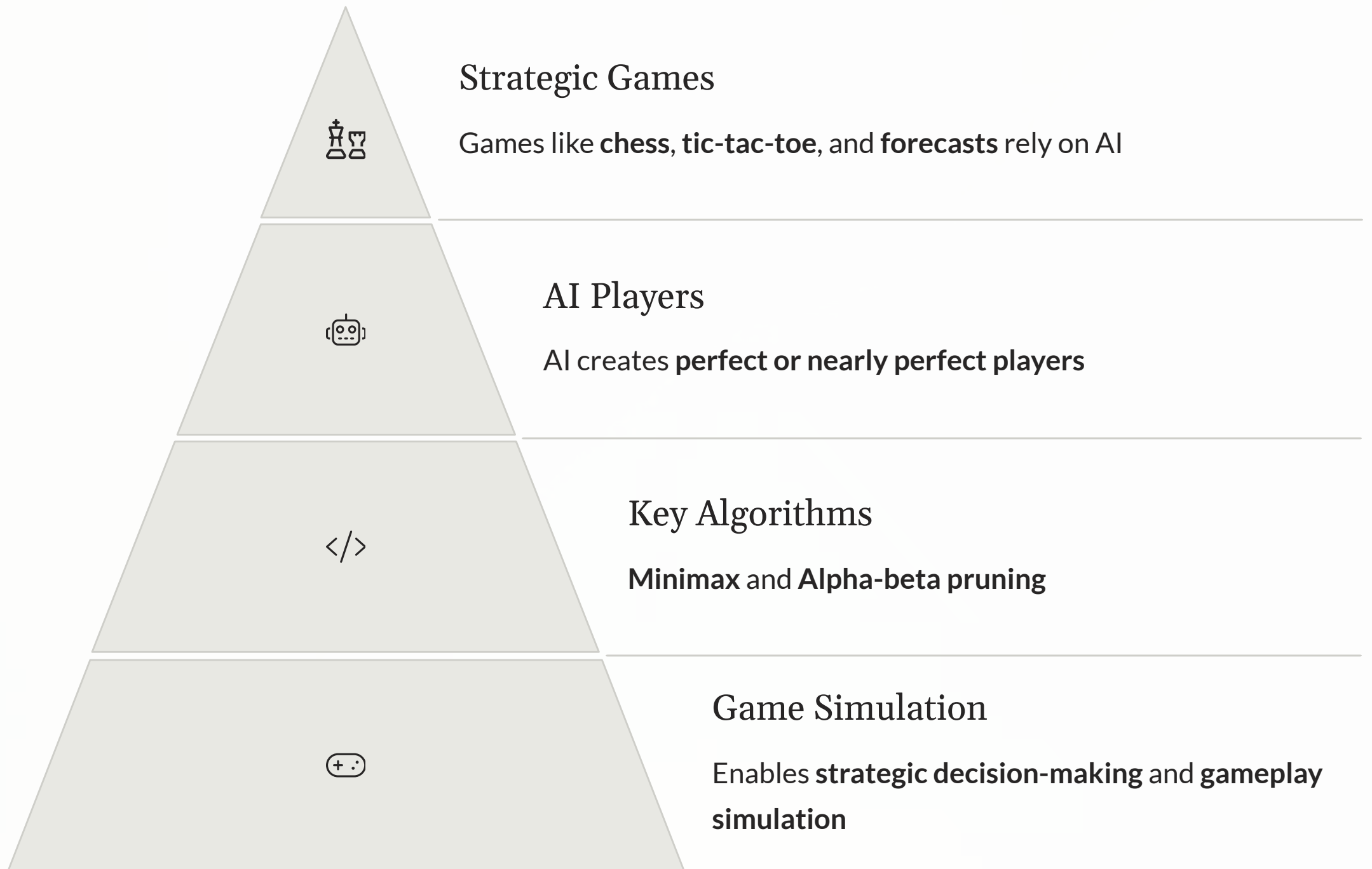
**Simulated annealing** avoids getting stuck in local optima

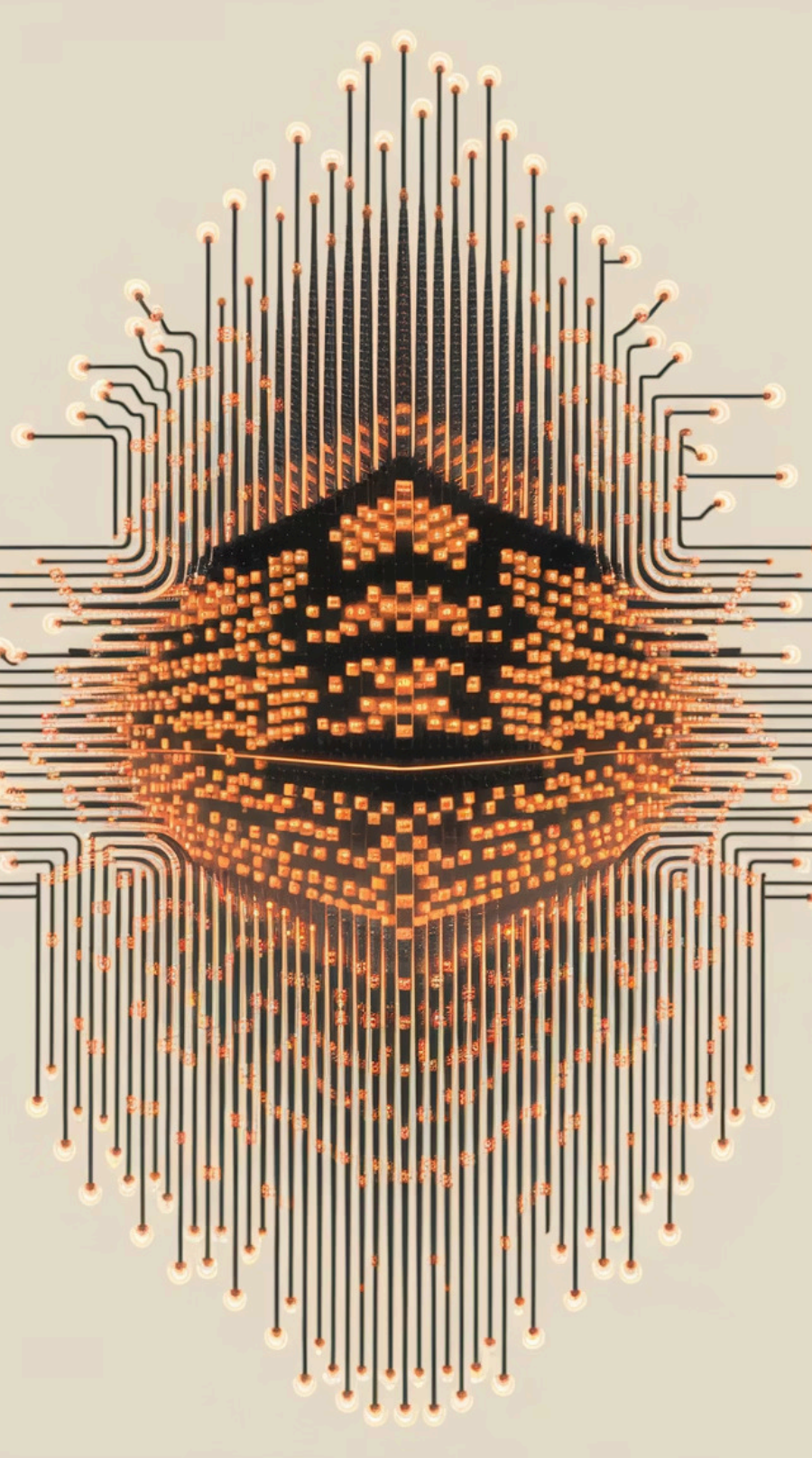
## Performance Benefits

These methods provide **fast, near-optimal solutions**



# AI in Game Development





# Neural Networks and Deep Learning



## Foundation of Modern AI

Central to modern AI advancements



## Recognition Applications

Effective for:

- Handwritten digit recognition
- Face recognition
- Natural Language Processing (NLP)



## Breakthrough Technologies

Deep learning powers breakthroughs in **vision** and **language**



# Final Thoughts

## Wide Applicability

AI is applicable across **robotics**, **games**, **optimization**, and **deep learning**

## Problem Solving

Solves real-world problems that are otherwise hard or impossible to solve efficiently

## Career Value

**Learning AI is worth it** — it opens the door to modern, intelligent systems

## Next Steps

Upcoming lectures will explore these topics one by one

