Notes, Chapter 1

Definition of AI

- "The art of creating machines that perform functions that require intelligence when performed by people." - Kurzweil, 1990
- "The branch of computer science that is concerned with the automation of intelligent behavior." - Luger and Stublefield

Different Types of AI

Focuses

- Thought processes and reasoning
- Intelligent Behavior - intelligent acts, such as a robot performing a task correctly

Two Dimensions of AI

- **Human vs Rational:** Does an AI emulate human patterns and irrationality?
- **Thought vs Behavior:** Does it think or act?

Types of AI

- Systems that think like Humans
- Systems that think rationally
- Systems that act like Humans
- Systems that act rationally

Acting Humanly: The Turing Test

A computer passes the test of a human tester, after posing some written questions, if the human cannot tell whether the written responses come from a person or from a computer.

A machine to model a human needs several capabilities:

- **Natural Language Processing:** to communicate successfully in a human language
- **Knowledge Representation:** to store what it knows or hears
- **Automated Reasoning:** to answer questions and draw a new conclusion
- **Machine Learning:** to adapt to new situations and to detect patterns

A **Total Turing Test** requires interactions with the real world, necessitating additional requirements:

- Computer vision and speech recognition to perceive the world
- Robotics to manipulate objects and move about

Thinking Humanly: Cognitive Modelling

Cognitive Sciences is an interdisciplinary field consisting of fields like Artificial Intelligence, Psychology, Linguistics, Philosophy, and Anthropology that tries to form theories of human behavior and reasoning.

Thikning Rationally: Laws of Thought

Reasoning using a mathematical model:

- **Logic:** encodes knowledge in formal logical statements and use mathematical deduction to perform reasoning
- **Probability:** the theory of Probability allows reasoning with uncertain information

Acting Rationally: Rational Agents

- An agent is an entity that perceives its environment and is able to execute actions to change it
- Agents have inherent goals that they want to achieve
- A rational agent acts in a way to maximize the achievement of its goals
- True maximixation of goals requires techniques from multiple science and unlimited computational abilities
- Limited rationality involves maximizing goals within the computational and other resources available

Foundations of AI

Many older disciplines contribute to a foundation for artificial intelligence.

- Philosophy
  - Can formal rules be used to draw valid conclusion?
  - Where does knowledge come from?
  - How does knowledge lead to action?
- Mathmatics
  - TODO Add stuff
- Economics
  - How should we make decisions in accordance with our prefereces?
  - How should we do this when the payoff may be far in the future?
- Neuroscience → How do brains process information?
- Psychology → How do humans think and act?

- Computer Science & Information → How can we build an efficient computer?
- Control Theory → How can machines operate under their own control?
- Linguistics → How does language relate to thought?

AI Applications

- Self-driving Cars
- Autonomous drones
- Autonomous planning and scheduling
- Machine translations
- Speech recognitions → Alexa, Siri, Cortana, Google Duplex
- Recommendations → Search, eCommerce
- Game playing → Deep Blue
- Image recognition
- Health Condition Diagnosis