The left side of the image features a dark blue background with a complex, glowing blue geometric pattern. This pattern consists of numerous thin, translucent blue lines and curves that overlap and intersect, creating a sense of depth and motion. The lines vary in intensity, with some appearing as bright highlights and others as darker shadows, giving the impression of a three-dimensional space.

Progress in AI

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Details

- ❖ Brief history of Artificial Intelligence
- ❖ Exploring the 4 types of AI
- ❖ Looking at examples of AI used in the modern world

History

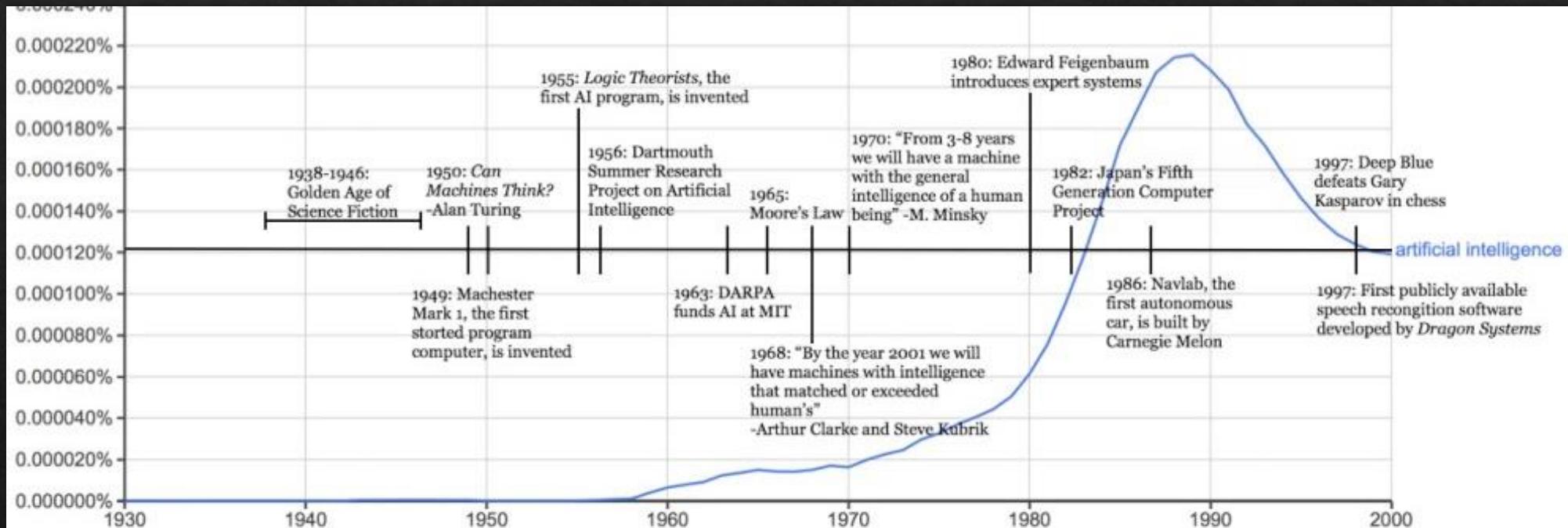
- ❖ In 1956, Allen Newell, Cliff Shaw, and Herbert Simon created The Logic Theorist, the first computer program designed to mimic human problem solving.
- ❖ John McCarthy hosted the first ever Artificial Intelligence conference in 1956, coining the term Artificial Intelligence in the process.
- ❖ The event catalyzed the next two decades of AI advancement, up until the mid 1970's.

History, cont.

- ❖ In the 1980's AI advancements were slowing due to lack of computer capabilities.
- ❖ This was solved by the invention of deep learning, a way to get AI to perform better by teaching them via experience.
- ❖ Now, AI was programmed to learn how to operate from an 'expert' and by repeatedly teaching themselves how to perform an operation that they otherwise could not have.
- ❖ Artificial Intelligence saw another, bigger boom in mid-to-late 1990's.

History, cont.

- ❖ 1997 saw the finalization of IBM's Deep Blue, a chess playing computer that was able to defeat the then current world champion Gary Kasparov in a match.
- ❖ This led to various other advanced creations such as machines that could display emotion, recognize and emulate human speech, and more.
- ❖ AI is still rapidly improving today, with AlphaGo developed by Google being able to defeat Go world champion Ke Jie in 2017.



Timeline

4 Types of AI

- ❖ The 4 ways to classify AI:

- ❖ Reactive Machines
- ❖ Limited Memory
- ❖ Theory of Mind
- ❖ Self Awareness

Currently, we have been able to fully develop machines that fall under the 'reactive' category, and have almost completely perfected Limited Memory machines.

Reactive AI

- ❖ Some input is received, and an output is given.
- ❖ No learning is done by the machine.
- ❖ Nothing is stored or remembered by the computer.
- ❖ These AI are the most simple types, were the starting point for Artificial Intelligence research in the 50's.

Limited Memory

- ❖ Limited memory machines are AI capable of storing and learning from past information.
- ❖ Unlike reactive agents, limited memory agents have access to much more detailed information about their world, including past events as well as predictions for future events.
- ❖ There are three main types of limited memory machines:
 - ❖ Reinforcement learning
 - ❖ Long short term memory (LSTM)
 - ❖ Evolutionary Generative Adversial Networks (E-GAN)

Reinforcement Learning

- ❖ Reinforcement Learning agents learn from prior states in order to gain new knowledge about potential future states.
- ❖ One such example is Deep Blue, the chess playing machine that defeated Gary Kasparov in 1997.
- ❖ This machine had access to millions of previous chess games which were used by the machine in order to check what the best possible move is as it plays the game.
- ❖ The process of reinforcement learning taught Deep Blue how to play the game by using these known states to search millions of potential outcomes for the game it is currently playing, and by repeatedly searching them and learning from their different outcomes as it searched each time.

LSTM

- ❖ Long short-term memory is a type of agent useful for things such as language processing and predicting.
- ❖ LSTM agents take into account what they have already seen and try to predict what states will follow, such as taking in a sequence of text and predicting what will come after it.
- ❖ Long short-term memory refers to how these agents process the data, by weighing more recently received data as more important than prior data.
- ❖ In the example of text reading and predicting, an LSTM agent will weigh the last few words in the sentence much more heavily while predicting than the beginning of the sentence.

E-GAN

- ❖ Evolutionary Generative Adversarial Networks are usually path finding agents.
- ❖ These agents will repeatedly path find using randomly generated (weighted) paths each time, getting closer to an optimal path each time.
- ❖ Each next path will have a better chance of reaching the goal/optimal path than the previous one did.
- ❖ The future path finders will learn from their 'parents' taking into account the previous paths and rewards earned on them in order to find the next path.

Theory of Mind

- ❖ Theory of Mind AI are still mostly in early development.
- ❖ These AI types will be able to interact with humans emotionally as well as provide information.
- ❖ Self-driving cars are a loose example of Theory of Mind AI, in the sense that they make decisions consciously taking into account human emotion (not running over people while traveling, etc.)
- ❖ Current common AI such as Siri are not Theory of Mind AI as they do not comprehend emotion in humans or are able to convey different emotions back to humans when in use.

Self Awareness

- ❖ These AI are still only works of science fiction, however could be possible someday.
- ❖ This agent would have self-awareness of its world, surroundings, existence, it would be an independent intelligence to the humans that created them.
- ❖ They would be able to think and act on their own, likely would be undistinguishable from humans in interaction, and could possibly even become smarter than the human beings that created them.

Examples of AI Today

- ❖ Starting from just a dream by Alan Turing in the 1950's, to early reactive agents in the 1960's, computer advancements which led to limited memory machines and the possibility of future machines with independent emotion and thought, AI have become integral to the fabric of society.
- ❖ Some examples of everyday AI and how they work..

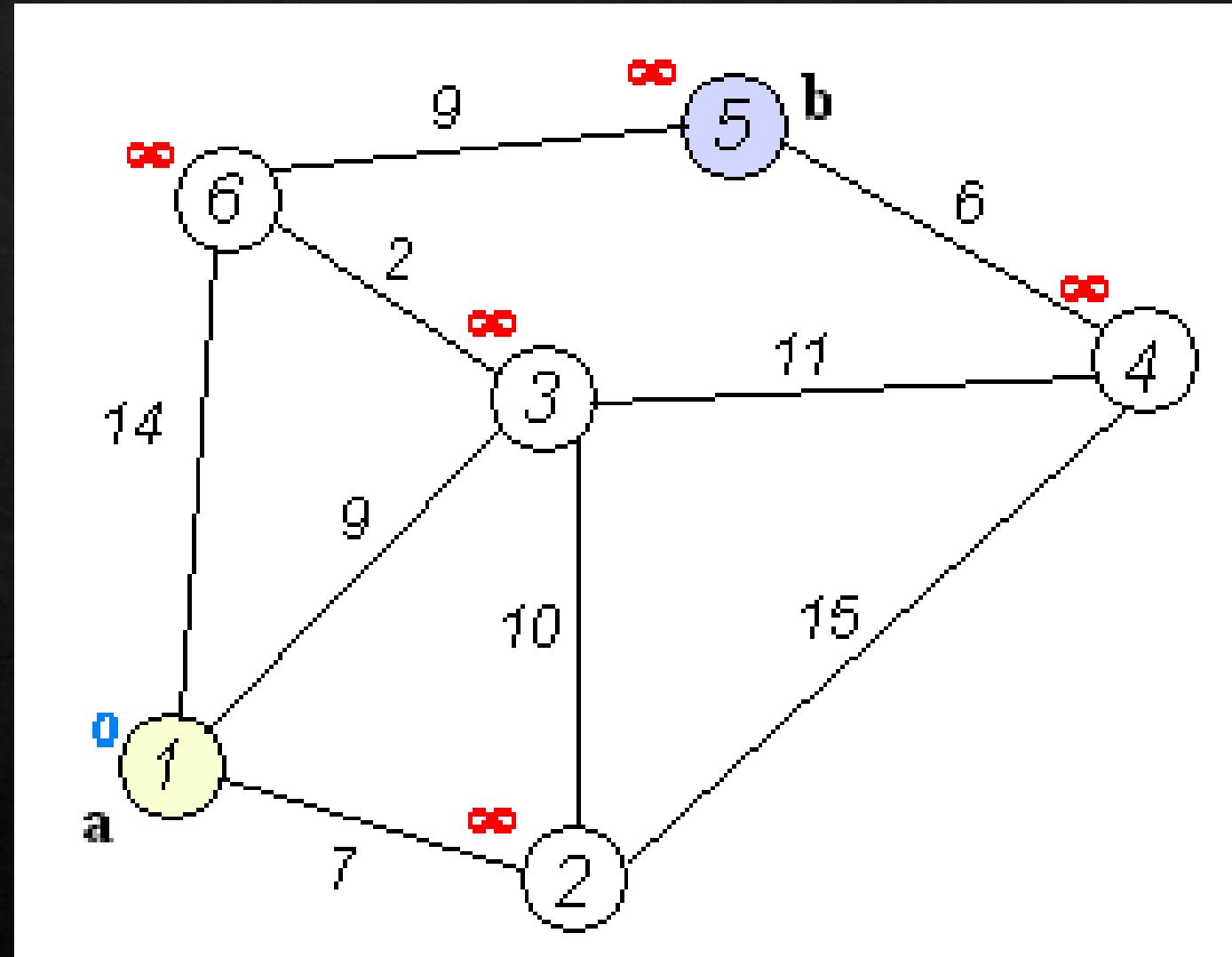
Google Maps

- ❖ Google Maps is a great example of a pathfinder, such as a limited memory E-GAN agent.
- ❖ Google is able to track real time traffic reports and predict the shortest possible route accounting for current traffic conditions to present to the user, using these search methods.



Maps Search

- ❖ A basic example of an agent such as one implemented in Google Maps.
- ❖ The agent performs a breadth-first search, demonstrating how an agent may search over nodes to find the shortest path to goal, however real-world scenarios are much more complex and utilize different search methods.



Rideshare Apps

- ❖ Ride sharing apps such as Uber and Lyft have been utilizing machine learning algorithms in order to train the apps to suggest the best possible ride to both the driver and the user.
- ❖ These agents have been trained in order to maximize driver availability while keeping the cost as low as possible for the users.
- ❖ The AI is also used to calculate things such as optimal pickup location, estimated arrival times, etc.

DeepBlue/Stockfish

- ❖ The chess playing computer created in the 1990's was a huge advancement in AI.
- ❖ However, many such machines exist commonly now that are stronger than DeepBlue was.
- ❖ Stockfish is an AI used on most popular chess websites in order ro provide users with detailed game results, such as showing you which moves may have been poor and what moves were recommended by the computer instead.
- ❖ These chess AI have as recently as 2019 seen a huge spike in efficiency by the implementation of neural networks in these machines.
- ❖ The current version of stockfish utilizing these neural networks is estimated to be about 10x stringer than pre-2019 stockfish.

Commercial Airlines

- ❖ Commercial airlines almost all use autopilot for flights.
- ❖ On average, it is estimated that there is only about 7 minutes of human input on a flight, normally just during takeoff and landing periods.
- ❖ Similar technology is being extended to self-driving road vehicles, which become more common every day via the likes of Tesla.
- ❖ However, we are still working towards developing fully autonomous vehicles and optimizing currently existing self-driving cars.

Alexa/Siri

- ❖ These AI have become arguably the most incorporated in our everyday lives.
- ❖ These machines are able to understand and process language by hearing a human talk, and give a reasonable answer to almost any complex question asked of it.
- ❖ While once a pipe dream of 1900's AI researchers, these AI are now so common they are taken for granted, are easily accessible to almost anybody, and work extremely efficiently and intelligently.

Conclusion

- ❖ AI development has come a long way in such a short time, with the field only existing for about 70 years.
- ❖ There is still much progress to be made, while we have theories of what AI are capable of we have yet to produce some forms of AI that we know can exist someday.
- ❖ AI went from an idea at a conference of computer scientists to arguably the most integral part of our modern society in less than a century.