Assignment-04

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1 The History of Artificial Intelligence

1.1 The inception of artificial intelligence

The first work in AI was done by taking neurons in the human brain as analogy and using Alan Turing's theory. The neurons could be on or off just like switch and this could implement any logical function. Hebbian Learning was used to update its strength later. First neural network was called SNARC. Newell and Simon's Logic program could prove complex theorems.

1.2 Early enthusiasm, great expectations

When AI researchers faced criticism that AI cant imitate human intelligence they responded by creating GPS (General Problem Solver) which led to famous physical symbol system hypothesis. Many such models were developed including Geometry Theorem Prover, checkers player etc.Early AI models were like blocks world, viewing tasks as manipulation of blocks with robots.

1.3 A dose of reality

Herbert Simon made bold predictions that AI would rival human intelligence. But early AI systems could solve simple problems but as the complexity increased they failed. Another setback was from neural networks and perceptrons. This led to decline in research.

1.4 Expert systems

Early AI models used general search mechanisms but these struggled in complex problems. DENDRAL was designed in stanford to determine molecular structure using spectrometry data. MYCIN was a model which diagnosed blood and performed better than many doctors. MYCIN incorporated certainty factors which seemed to fit well with how doctors analyzed.

1.5 The return of neural networks

Back Propagation algorithm is the heart of may AI systems , allowing them to adjust based on errors and improve their performance. These connectionist models were seen by some as competitors to both symbolic and logistic approaches. They also have the capability to learn from examples—they can compare their predicted output value to the true value on a problem and modify their parameters to decrease the difference.

1.6 Probabilistic reasoning and machine learning

The expert models in AI shifted to probability instead of boolean logic and machine learning instead of manual coding. AI research started to depend on experiment results than intuition. AI merged back again into control theory and statistics.Rich Sutton's work used reinforcement theory to Markovs decision processes. This era witnessed a lot of reunification that provided benefits both in application and better theoretical understanding.

1.7 Big Data

Now because of web we can create a huge data set to train our AI models. Most of these data sets are unlabeled. Banko and Brill argued that the improvement obtained by increasing data set is much higher than what is obtained by tweaking the algorithm. Such big data set was a secret recepie behind IBM Watson's success in Jeopardy.

1.8 Deep Learning

Deep Learning is kinda machine learning using multiple layers of computing elements.A huge breakthrough was observed when Hinton's team at University of Toronto outperformed previous methods of classifying images.Deep learning relies on powerful hardware. We need GPU's for this which are 10^7 times faster than a CPU.

2 Risks and Benefits of AI

AI can play an important role in the economic, social, scientific and military spheres. But there is always two faces of any coin so AI poses some risks as well.Google DeepMind CEO said that "First Solve AI, then use AI to solve everything else". Some potent risks with AI include Lethal Autonomous weapons that can locate and kill enemies without human intervention. AI is used for mass surveillance, but this data about public behavior can be used to influence political decisions. Bias in AI is another major issue , algorithms can favour certain groups based on gender , race and other factors.AI may take away jobs of people spreading unemployment all around. AI has been used in self driving vehicles these days , but can lead to safety issues and accidents. AI can be used to make cyber attacks more efficient and powerful by hackers leading to leakage of personal data. As AI become more capable of doing humanly things they may take advantage of the situation just like humans did in their roles. Therefore self-governance principles for AI-related activities are being established. In the long run the big question is whether we will create AI as even more intelligent ?. For many years two goals were prioritized one creating HLAI and another AGI. If AI becomes more intelligent than humans, there's a fear that we may lose control, similar to how humans evolved to be better than gorillas. There is a story in Greek myth of King Midas, who wished for everything he touched to be gold. He soon regretted it when his food , drink and even his family turned into gold. This is exactly what happens with AI because it can give us what we wish for but not in the way we want.
Now machines are programmed in a way that they turn off if they are unsure about human goals.Assitance games which describe mathematically the situation in which a human objective is achieved starting from a uncertain situation. Inverse reinforcement learning that allow machines to learn more about human preferences by learning about the choices of humans.

3 Top 10 Takeways

AI is better than humans in tasks like image recognition, visual reasoning and English but trails behind in competition-level maths and planning skills.Industry is leading in AI research than universities. Training costs pf AI models have reached unprecedented levels. United States still lead the field of AI models. Even after such investments the AI models lack standardization significantly. The investment in Generative AI skyrockets despite decline in overall AI private investment last year.AI's impact on productivity was evident, improving worker performance and bridging skill gaps. But there is a note of caution that AI without proper oversight can lead to diminished performance. There has been significant boom in the scientific discoveries by AlhpaDev.The number of AI regulations in United States sharply increase by 56.3% as compared to last year.People have started to be more aware about the impact of AI and also more worried. 52% people were concerned than excited about AI.

4 Report Highlights

4.1 Research and Development

In 2023 , the AI field witnessed more AI models from industry as compared to universities. More number of foundation and open source models are released.Training cutting edge models like GPT-

4 and Gemini is costing millions in computational resources.Open source on AI skyrocketed on github.AI publications tripled from 2010 to 2022.

4.2 Technical Performnace

In 2023 AI was better than humans in image classification and language understanding but trailed behind in maths and reasoning. As AI reaches its limits on older benchmarks, new, tougher benchmarks have been introduced to push performance further. Human evaluation is now playing a bigger role in assessing AI performance.But overall closed AI models are still better then open AI models in terms of benchmark scores.

4.3 Responsible AI

New research from the AI Index reveals a significant lack of standardization in responsible AI.Political deepfakes,which can be easily created with AI are impacting election results and moreover it tough to detect them.Businesses are more concerned about AI risks but have not addressed them completely.ChatGPT has shown political bias as well.

4.4 Economy

In 2023, investment in generative AI surged to 25.2 billion, despite a decline in overall AI funding.U.S is still leading in terms of investment as compared to China and Europe. Although AI job postings in U.S decreased , businesses are seeing significant benefits. China leads in industrial robotics.

4.5 Science and Medicine

In 2023 , AI significantly advanced scientific and medical feilds.AlphaDev improves algorithmic sorting and GNoME which helps in material discovery.EVEscape and AlphaMissence were launched to enhance pandemic prediction and mutation classification.The FDA approved a record number of AI-related medical devices in 2022.

4.6 Education

In 2023, several trends emerged in computer science (CS) education. The number of American and Canadian CS bachelor's graduates continues to rise.But there is a shift of AI PHD's into industry than academia.The proportion of international students in CS programs in the US and Canada has also decreased. So overall the CS degree which was favoured a lot is getting less popular with AI spreading all around.

4.7 Policy and Governance

The number of AI-related regulations in U.S increased to 25 from one in 2016. Both U.S and the European Union made AI Act to regulate the usage of AI.The year 2023 witnessed a remarkable increase in AI-related legislation at the federal level, with 181 bills proposed.

4.8 Diversity

In recent years, the diversity of CS students in the U.S. and Canada has been increasing, with more Asian, Hispanic, and Black or African American students earning bachelor's, master's, and PhD degrees. In the US K-12 education system, diversity is also seeing a major improvement with more female students participating in AP CS exams.

4.9 Public Opinion

In 2023 people all around the world are aware and more concerned about AI. A survey showed that more proportion of people are worried about impact of AI rather than being excited. There is a difference of opinion in this matter when you observe generation gap. Younger generations are more optimistic than older ones.ChatGPT is the most famous open source AI model used by almost everyone today.