

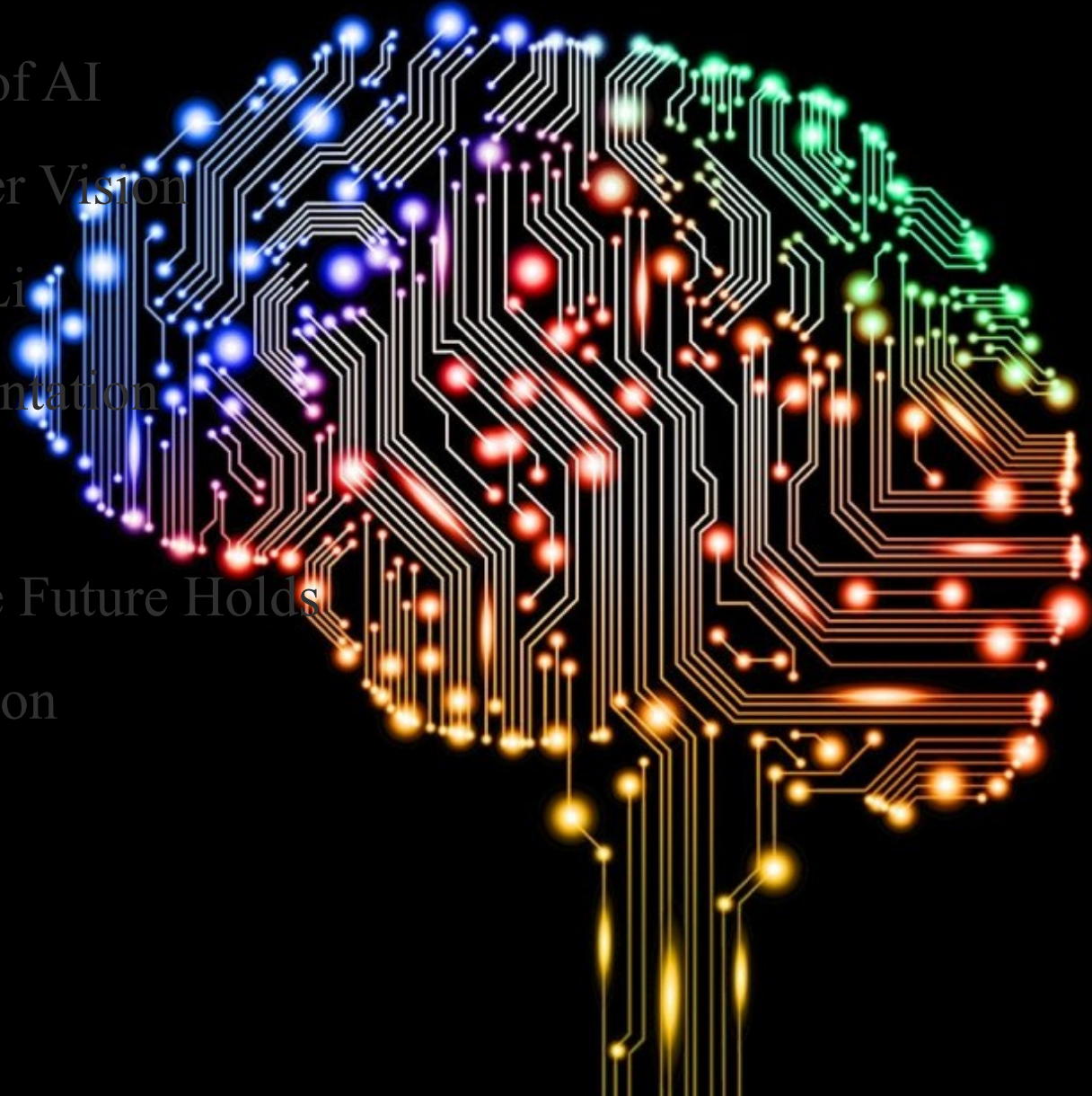


The Search for a Thinking Machine

By Daniel O'Laughlin

OUTLINE

- History of AI
- Computer Vision
- Fei-Fei Li
- Implementation
- Results
- What the Future Holds
- Conclusion



- Alan Turing speculated about a thinking machine in the 1950's
 - “Artificial Intelligence” coined by Prof John McCarthy in 1956
 - AI winter- period of academic dead ends
 - 1990s shift from logic based approach to statistical approach using huge datasets
 - 2000s faster processing power, ready availability to large amounts of data signaled turning point for AI
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Computer Vision

- Computer vision is a field that includes methods of acquiring, processing, analyzing, and understanding images and data from the real world
- Obtaining computer vision is a critical step in creating a thinking machine because it gives machines the ability to understand and perceive their environment allowing the machine to make informed decisions.



Fei-Fei Li

- Fei-Fei Li is a researcher and head of the computer vision laboratory at Stanford University
- She has spent the last 15 years teaching computers how to see
- She maintains that visual processing is analogous to sight in a child



Li's Approach

- Li lessened emphasis on better algorithms, and heightening emphasis of providing algorithms with training data in order to improve themselves
 - However, this requires need a ton of data
 - She began labeling a billion diverse images from the internet
 - The underlying theory behind this methodology was that if the machine saw enough picture a cat, it would be able to recognize a cat in real life
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- She employed a team of 50,000 workers to label millions of random images of cats, planes, people etc.
 - These labeled images were used to create ImageNet
 - The ImageNet database has been used by researchers around the world who are attempting to give machines vision
 - Every year Stanford has a competition with Google, Microsoft, and Baidu to test how well the machines of these tech giants perform using ImageNet.
 - Within the last few years the machines have gotten very good at recognizing images, yielding only a 5% error rate
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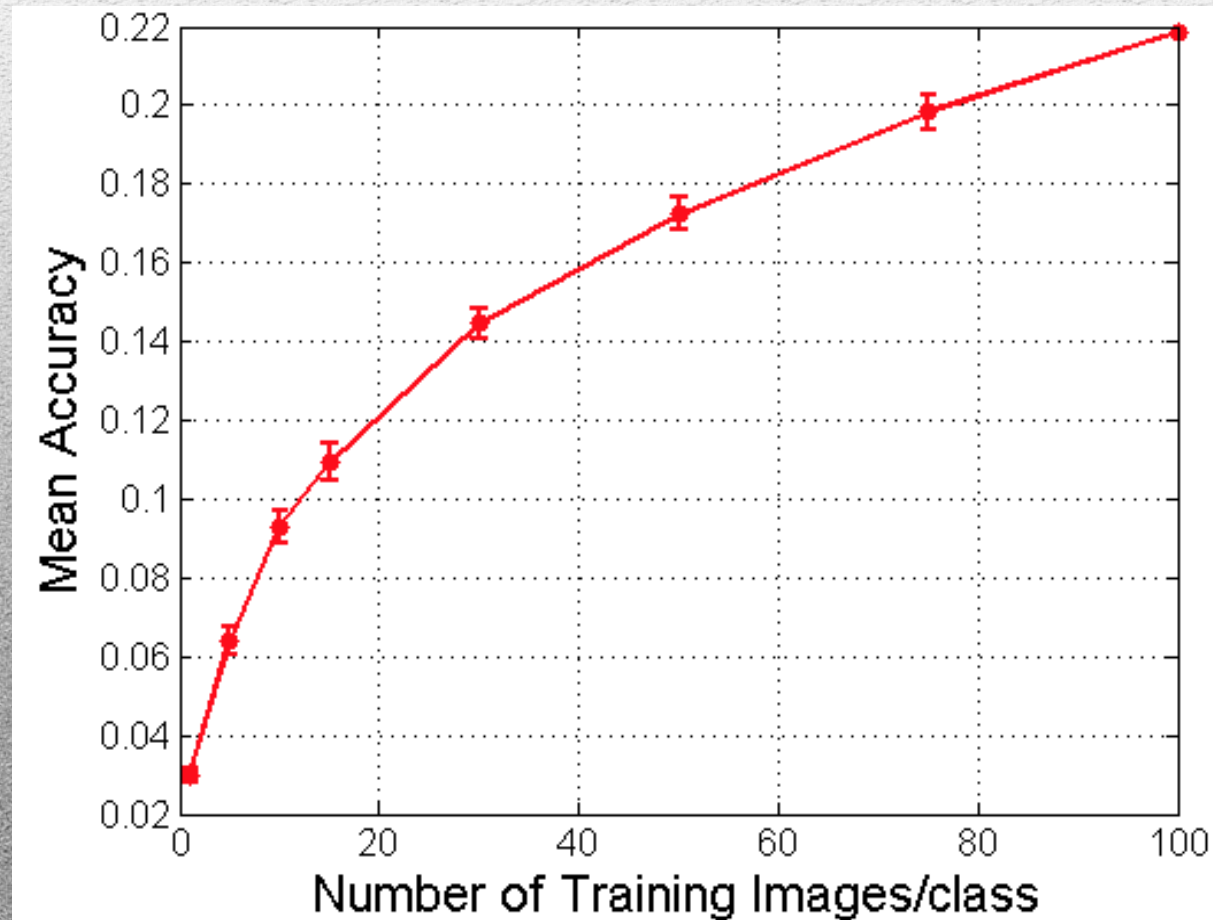
Accuracy Provided Limited Images

Mean Accuracy

The number of training images per class is varied from 1-100

Comparison of Accuracy per Class

The accuracy of each class is compared for 15 and 100 training images per class



Implementation

- In order to teach the computer to recognize images, neural networks are used
 - Neural networks are computer programs assembled from artificial brain cells that learn and behave in a remarkably similar way to human brains
 - Hundred, thousand, or even million of artificial neurons arranged in layers
 - Each layer interprets part of the image
 - Up to 30 layers
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Stanford's Machine

- Stanford's image reading machine has been very successful at accurately captioning images
 - Still makes mistakes
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Machine Produced Captions



"man in black shirt is playing guitar."



"construction worker in orange safety vest is working on road."



"two young girls are playing with legos toy."



"boy is doing backflip on wakeboard."



"girl in pink dress is jumping in air."



"black and white dog jumps over bar."



"young girl in pink shirt is swinging on swing."



"man in blue wetsuit is surfing on wave."

Stanford's Machine



This image was incorrectly captioned, “a young boy is holding a baseball bat”

Despite success, still a lot of work to be done

However...

- Machine still only has the visual intelligence of a three year old
- Does not understand context, as a toddler would

CAUTION

A black stick figure is shown falling backwards over the word 'CONTEXT'. Red lines radiate from the figure's head, suggesting a fall or impact. The figure is positioned between the word 'CAUTION' and the word 'CONTEXT'.

**NO
CONTEXT
NEEDED.**

What Sets This Apart?

- Other artificially intelligent machines have been launched in the past
 - 1997: IBM's DeepBlue chess machine
 - 1999: Sony's AIBO pet robots
 - 2002: Roomba, an autonomous vacuum cleaner
 - 2011: Siri, Google Now, Cortana
 - However, what sets apart computers that can interpret images is their ability learn from experience. They do not simply behave according to a set of mathematical rules. The ultimate aim is to have machines be able to perceive the conditions of their environment and act accordingly, thus TRULY thinking
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What's Next?

- Make machines understand whole scenes in context, human behavior, and object relationships
- “The ultimate aim is to create "seeing" robots that can assist in surgical operations, search out and rescue people in disaster zones and generally improve our lives for the better” -Li



Conclusion

- At the moment, machines are learning, not thinking
 - There is debate whether or not machines can be programmed to think because the nature of human thought has eluded scientists and philosophers alike for centuries
 - However, machine brain is only going to get smarter...
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