ECE 1508: Applied Deep Learning

Chapter 1: Preliminaries

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Deep Learning More than Ever

Deep learning is turning into an *unbeatable champion*

- It has achieved accuracy levels in image classification, restoration, and segmentation that surpass human capabilities
- It can create human-like conversational dialogues and respond to scientific and technical questions
- It can beat world-class chess players
- It has solved problems that had not been effectively addressed for a long time

We all have items to add to this list!

The Unbeatable: *AlexNet* ⇝ *ResNet*

Image recognition has been one of the first problems in AI

we want the machine to recognize what in an image is

- Yann LeCun proposed LeNet in 1998
- In 2010, ImageNet started the annual contest

  ImageNet Large Scale Visual Recognition Challenge

  ↳ AlexNet (2012) ⇝ VGG and GoogLeNet (2014) ⇝ ResNet (2015)
- Currently, we have much *deeper* and advanced neural networks

We will get what these networks are and do in this course

The Unbeatable: *AlexNet* ⇝ *ResNet*

In February 2015, first Microsoft and then Google announced that

their deep neural networks beat human accuracy in image recognition

FORBES > TECH

Microsoft's Deep Learning Project Outperforms Humans In Image Recognition

Michael Thomsen Former Contributor ⓘ

I write about tech, video games, science and culture.

Feb 19, 2015, 01:06pm EST

DESIGNLINES | INDUSTRIAL CONTROL DESIGNLINE

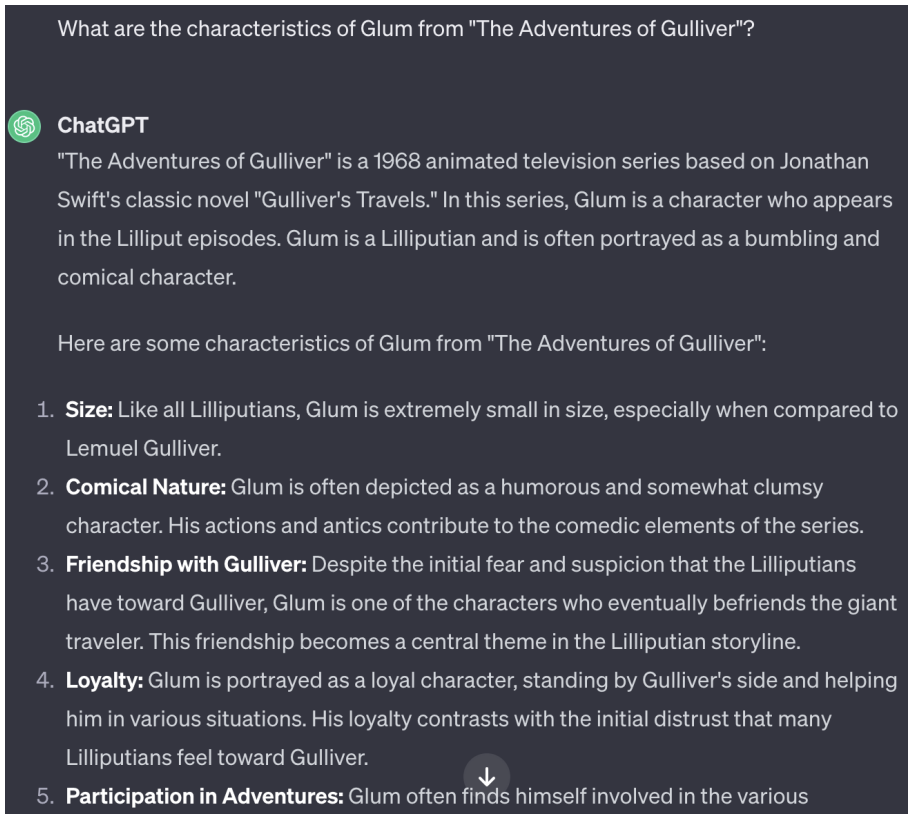
Microsoft, Google Beat Humans at Image Recognition

By R. Colin Johnson 02.18.2015 0

The Unbeatable: *ChatGPT*

Making a human-like dialogues had been another fundamental problem in AI

↳ ChatGPT broke the record of fastest-growing software in history



The Unbeatable: *AlphaZero*

Computers playing chess: *a long-going goal in AI*

- *1951*: Alan Turing designed a program that plays chess
- *1989*: Gary Kasparov defeated IBM's Deep Thought
- *1996*: Gary Kasparov defeated IBM's Deep Blue
- *1997*: IBM's Deep Blue defeated Gary Kasparov
- *2005*: Ruslan Ponomariov was the last person beating AI chess player
- *2017*: DeepMind released AlphaZero algorithm
  - ↳ AlphaGo ⇝ AlphaGo Zero ⇝ AlphaZero
  - ↳ After 24 hours of training it defeated Stockfish chess engine
- Even newer AI chess players, e.g., *Leela Chess Zero (2019)*

The Unbeatable: *Neural Machine Translation*

Most translator machines were unreliable until AI kicked in!

- Computer-based translation is a research topic since 1950s
- In 2000s, statistical machine translation (SMT) became dominant
- In 2010s, neural machine translation (NMT) showed great potentials
  - ↳ *Baidu launched first large scale NMT in 2015*
  - ↳ *Google introduced its NMT called GNMT in 2016*
  - ↳ *DeepL was launched in 2017*
- *And again: lots of NMT nowadays are getting developed!*

Notion of Deep Learning

Glum starts this conversation

+ *Well! Nice examples! But, what exactly is this Deep Learning?*
- Deep Learning refers to the subset of Machine Learning that uses Deep Neural Networks to execute a given learning task
+ *Wait a moment! The only thing that I understood is that Deep Learning is a form of Machine Learning! But,*
  - *what is Machine Learning itself?*
  - *what are Neural Networks in the first place? Before we talk about their "deep" version*
  - *what do you mean by a "learning task"?*
- We are going to understand all of them!
  - First, we start with the concept of Machine Learning