

# ECE 1508: Applied Deep Learning

## Chapter 1: Preliminaries

Ali Bereyhi

`ali.bereyhi@utoronto.ca`

Department of Electrical and Computer Engineering  
University of Toronto

Winter 2025

# 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 $\rightsquigarrow$ 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)  $\rightsquigarrow$  VGG and GoogLeNet (2014)  $\rightsquigarrow$  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 $\rightsquigarrow$ 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

What are the characteristics of Glum from "The Adventures of Gulliver"?



ChatGPT

"The Adventures of Gulliver" is a 1968 animated television series based on Jonathan Swift's classic novel "Gulliver's Travels." In this series, Glum is a character who appears in the Lilliput episodes. Glum is a Lilliputian and is often portrayed as a bumbling and comical character.

Here are some characteristics of Glum from "The Adventures of Gulliver":

1. **Size:** Like all Lilliputians, Glum is extremely small in size, especially when compared to Lemuel Gulliver.
2. **Comical Nature:** Glum is often depicted as a humorous and somewhat clumsy character. His actions and antics contribute to the comedic elements of the series.
3. **Friendship with Gulliver:** Despite the initial fear and suspicion that the Lilliputians have toward Gulliver, Glum is one of the characters who eventually befriends the giant traveler. This friendship becomes a central theme in the Lilliputian storyline.
4. **Loyalty:** Glum is portrayed as a loyal character, standing by Gulliver's side and helping him in various situations. His loyalty contrasts with the initial distrust that many Lilliputians feel toward Gulliver.
5. **Participation in Adventures:** Glum often finds himself involved in the various

# 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 Ponomarev was the last person beating AI chess player
- 2017: DeepMind released AlphaZero algorithm
  - ↳ AlphaGo  $\rightsquigarrow$  AlphaGo Zero  $\rightsquigarrow$  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