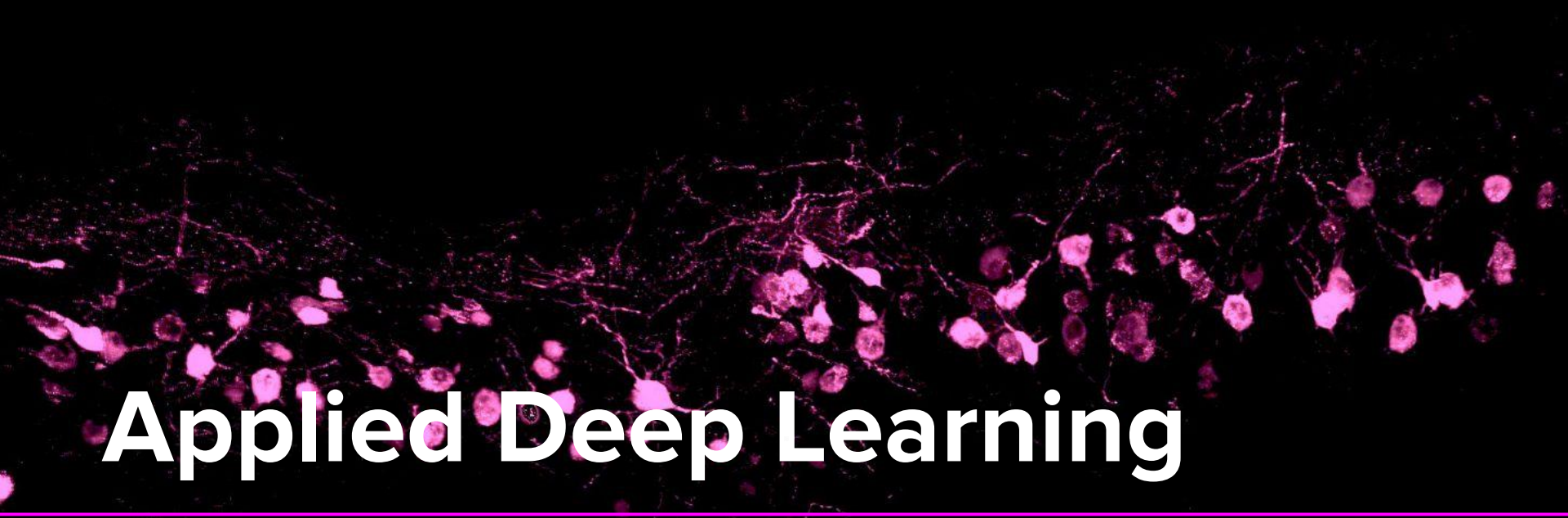


Applied Deep Learning

Introduction to Deep Learning
2025 / 2026

Alexander Pacha - TU Wien

Is this spam?

Congratulations! You have won €650.000,00 in the monthly Euro Millions / Google Promo lottery on April 26th 2019.

Please consult timothey.berrel@my-email.com for claiming your winnings with the following information:

1. Full Name
2. Address
3. Birth Date
4. Credit Card Number
5. CVC Checksum

Robert Avthantilayn
Online Coordinator

Is this spam?

Greetings,

I am Mrs. Margaret Ko May-Yee, Deputy Chairman and Managing Director of the Chong Hing Bank Limited. I write briefly to seek your collaboration in a multi-million transaction with good return for us on participation. Reply for details.

Regards,
Margaret Ko May-Yee

What do you see?

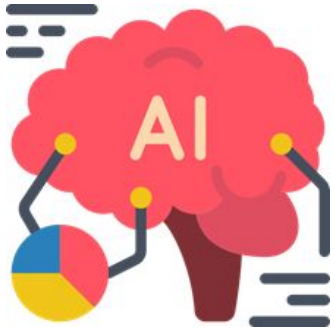
[Fig-2]

What do you see?

[Fig-3]

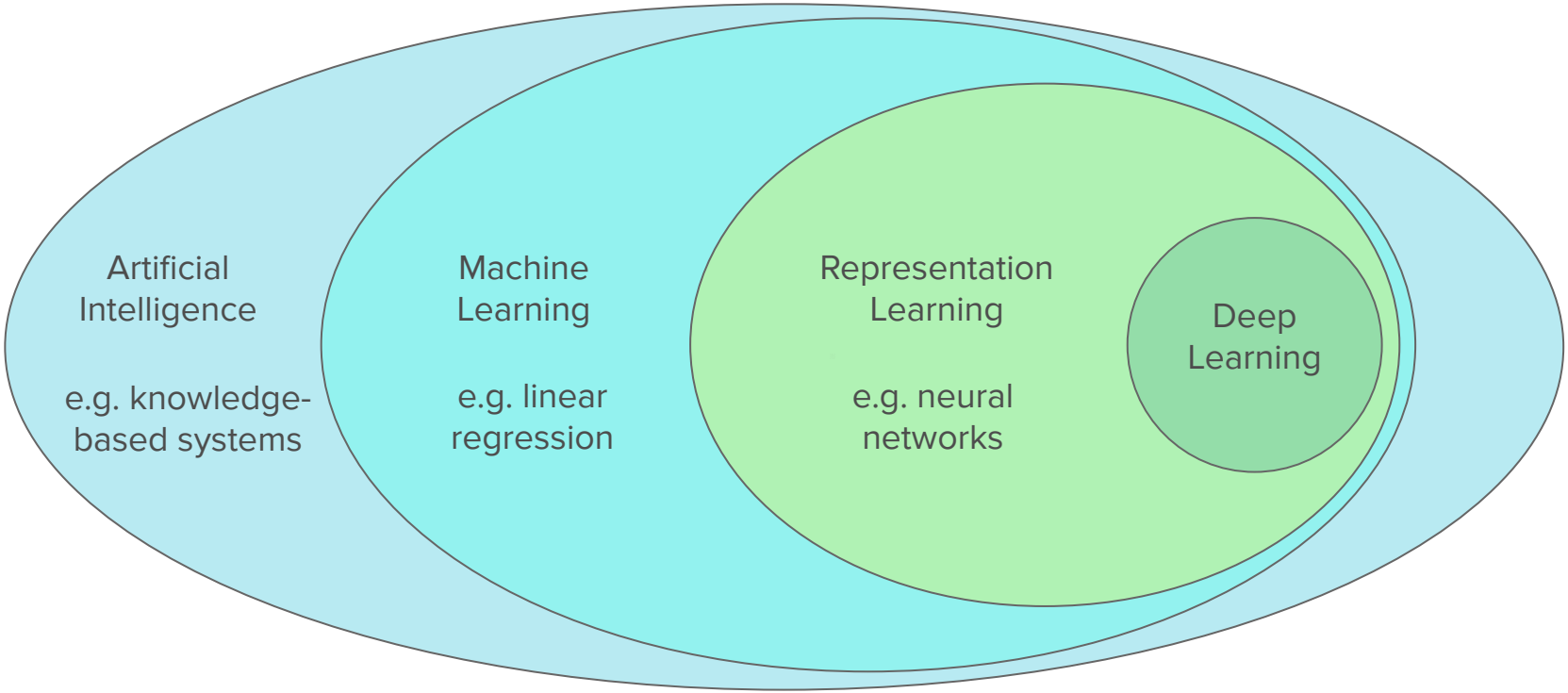
Machine Learning as Alternative

- Classical Programming quickly reaches its limits in certain situations
- Machine Learning can be a viable alternative to imperative programming

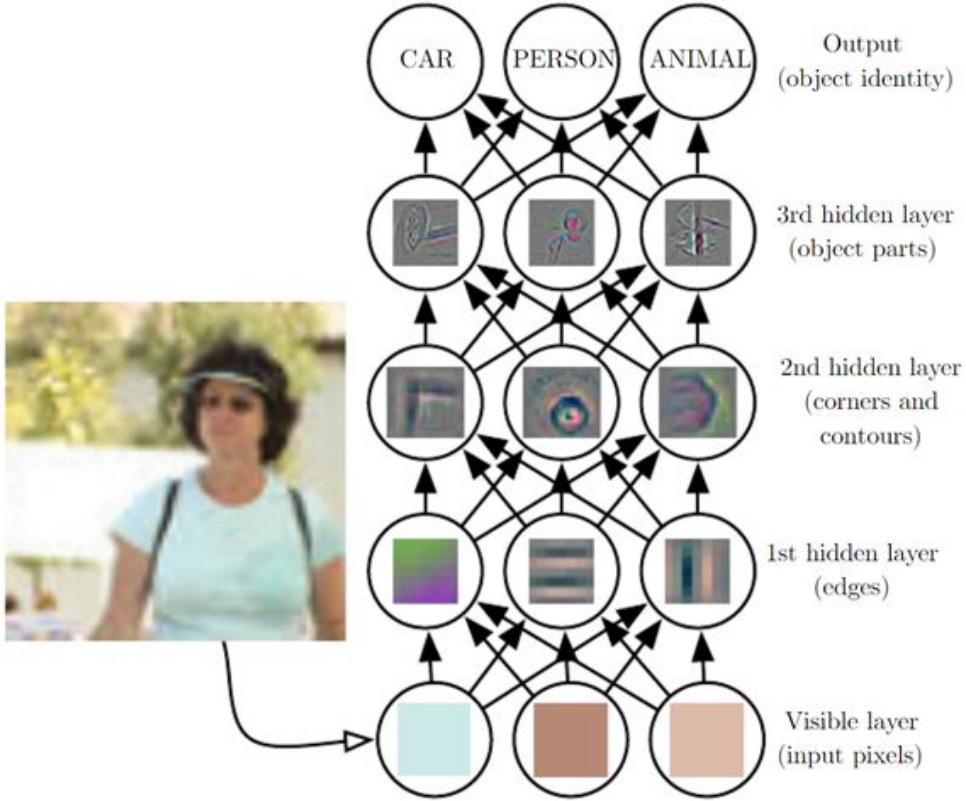


Machine Learning = Use data (Training) to answer questions (Inference)

Terminology

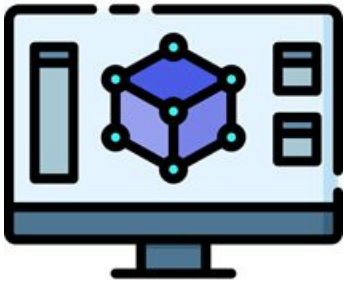


Meaningful Representation



[1]

How Can a Machine Learn?



Model

Loss function

Optimization function

Image Classification

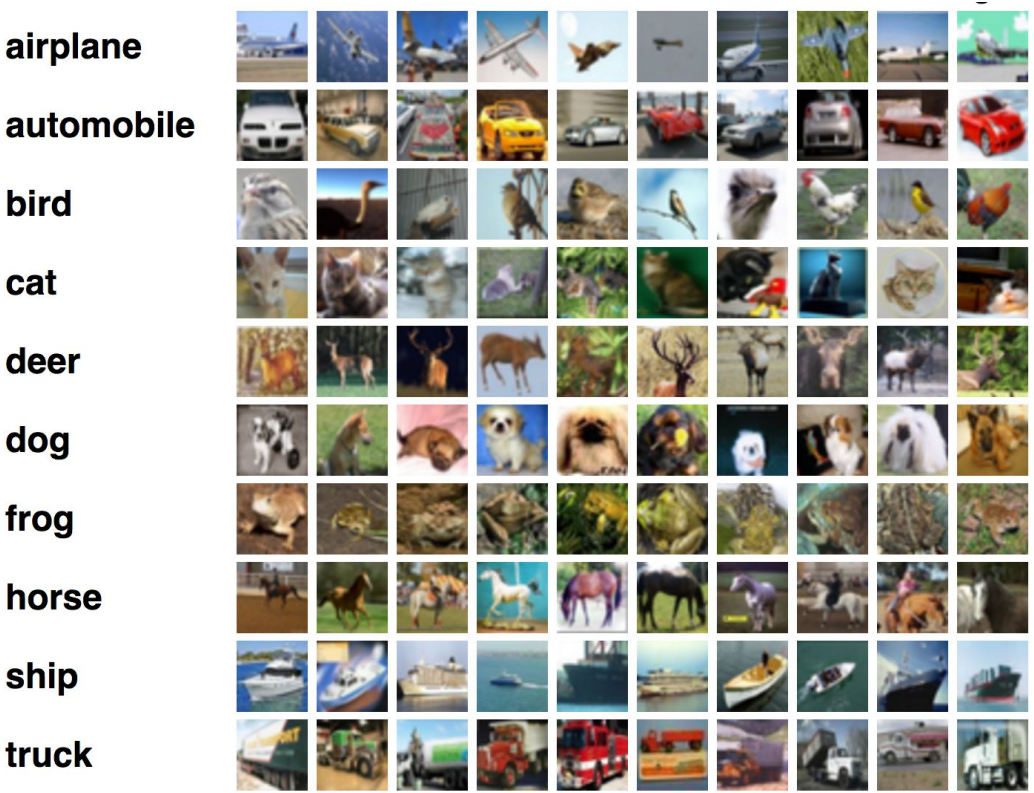
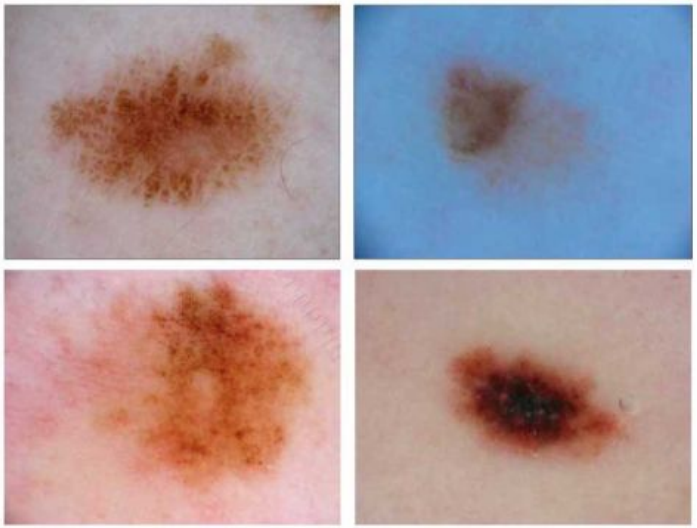
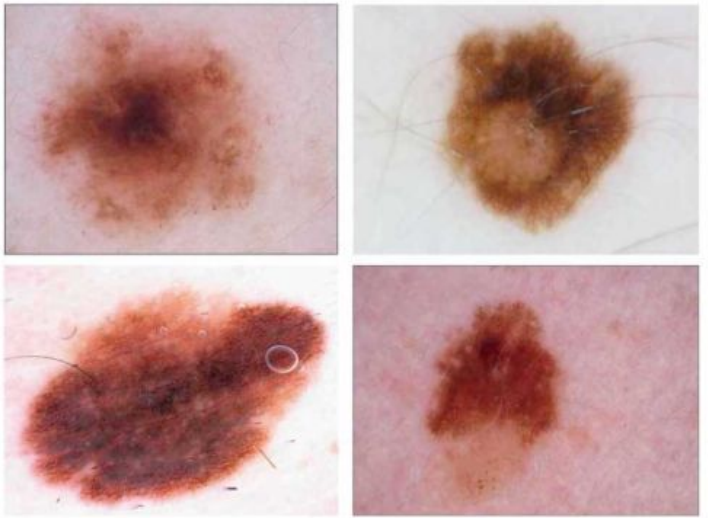


Image Classification

Melanoma

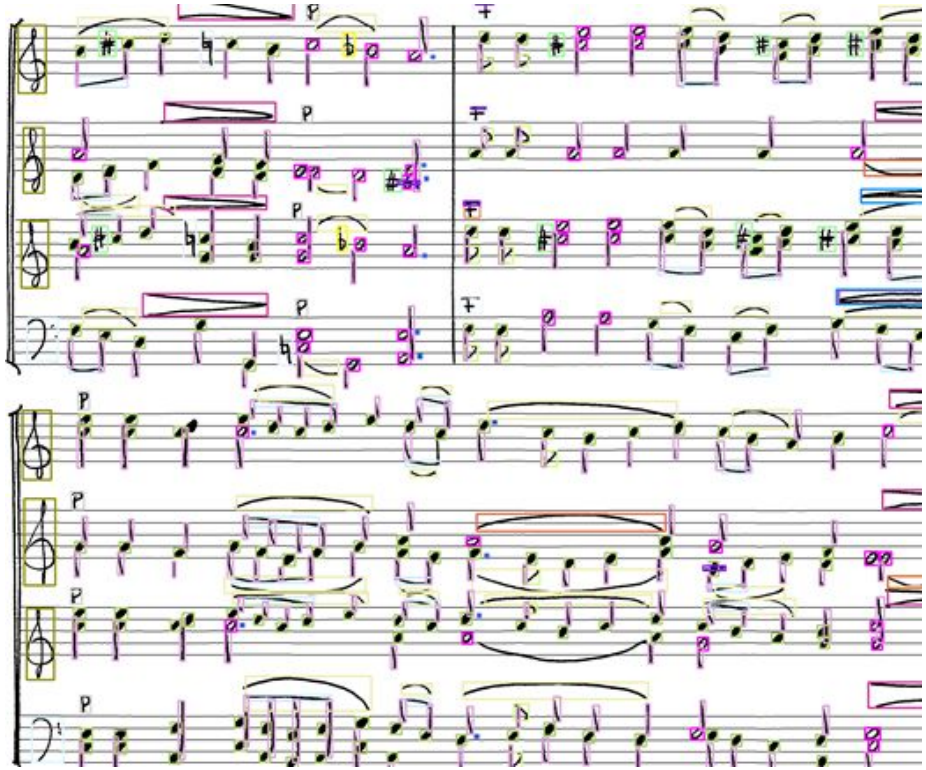


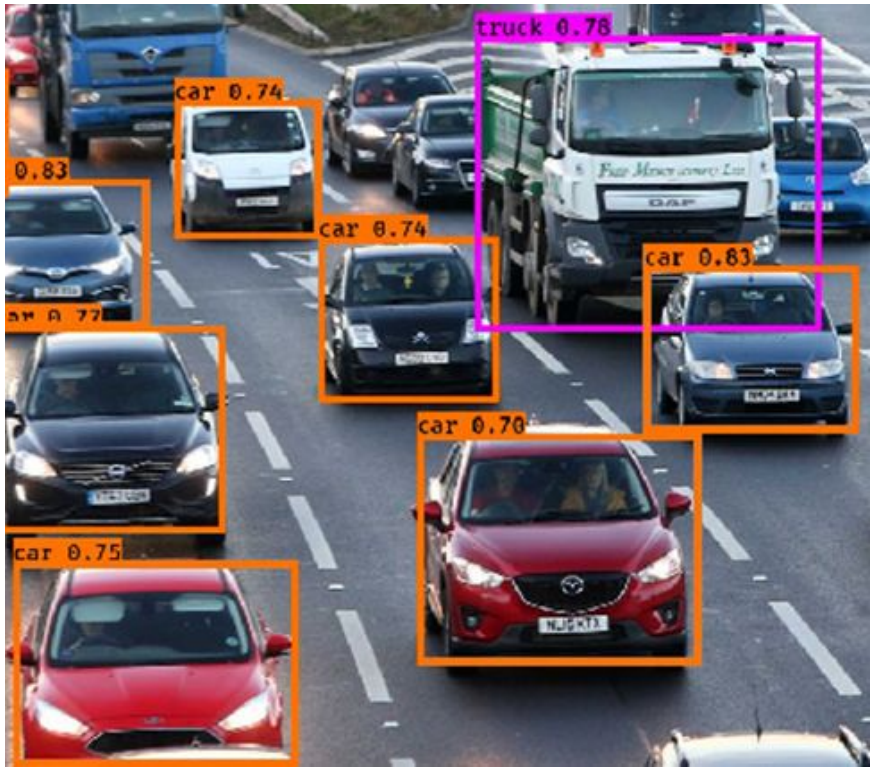
Benign



[5, 6]

Object Detection

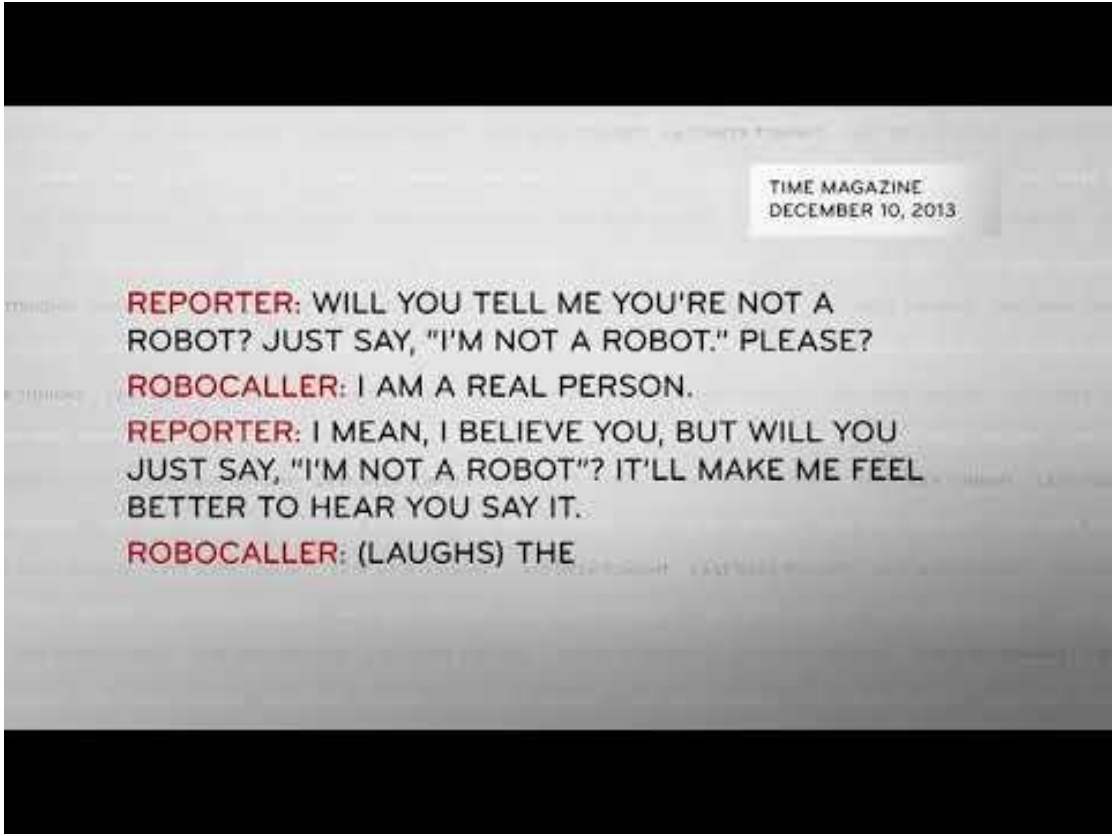




Voice Recognition and Natural Conversation

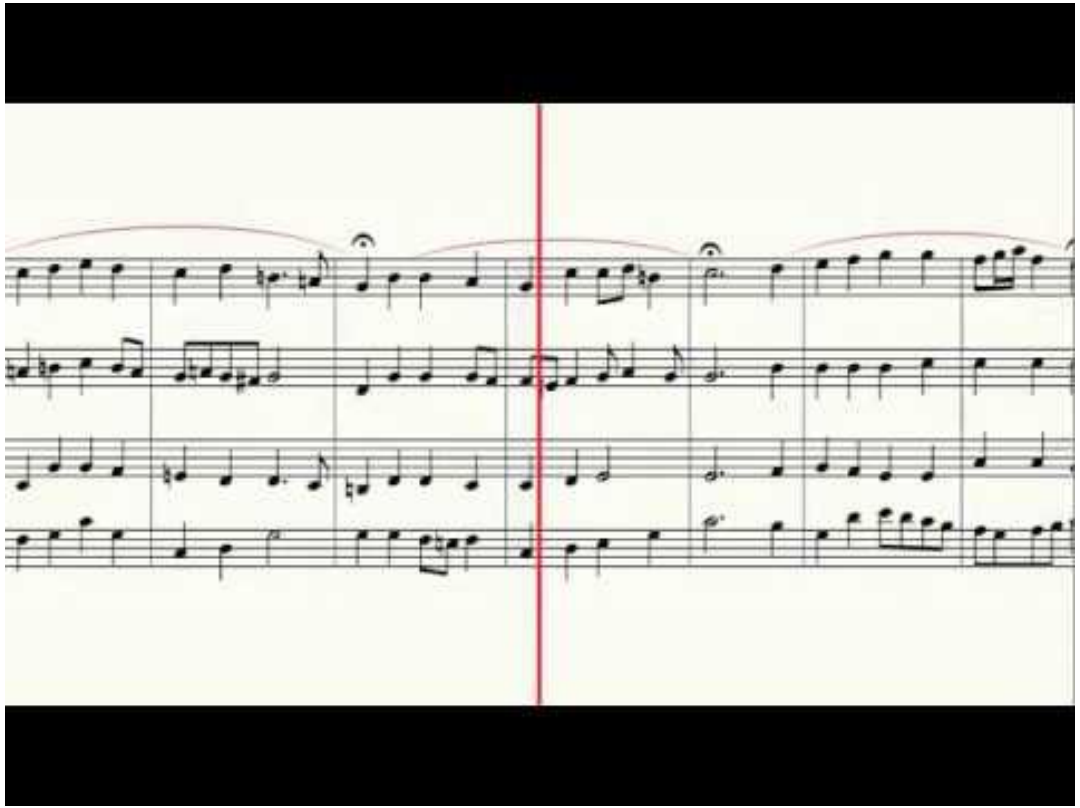
Google Duplex calls a hairdresser

Robo Calls

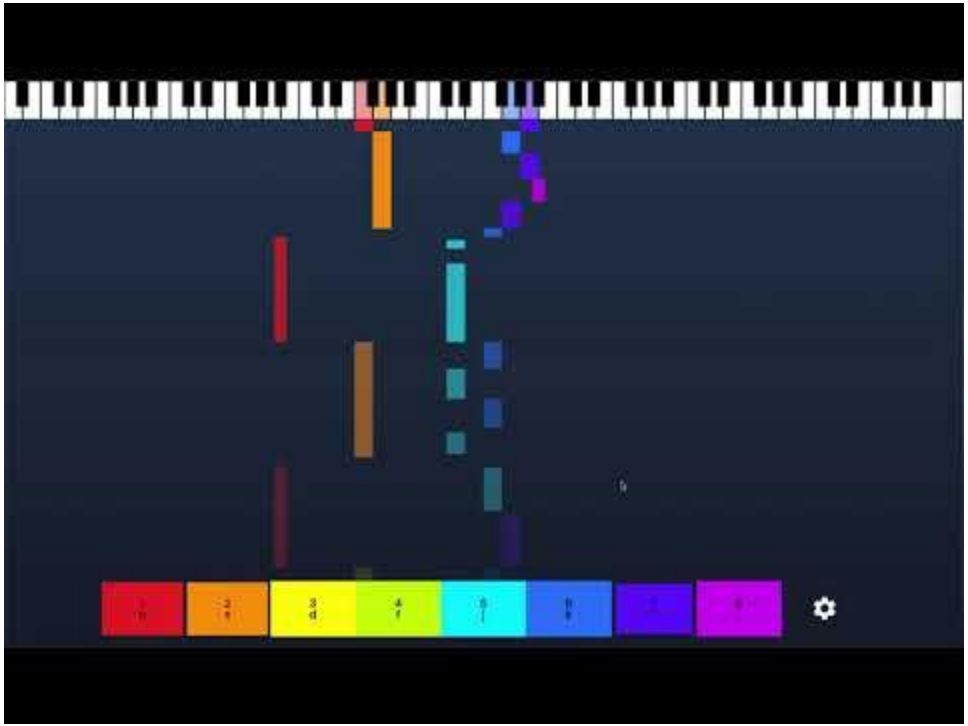

TIME MAGAZINE
DECEMBER 10, 2013
REPORTER: WILL YOU TELL ME YOU'RE NOT A ROBOT? JUST SAY, "I'M NOT A ROBOT." PLEASE?
ROBOCALLER: I AM A REAL PERSON.
REPORTER: I MEAN, I BELIEVE YOU, BUT WILL YOU JUST SAY, "I'M NOT A ROBOT"? IT'LL MAKE ME FEEL BETTER TO HEAR YOU SAY IT.
ROBOCALLER: (LAUGHS) THE

Music Harmonization

DeepBach



Creating new music



Creating new music

Creating Images from Text

Text Prompt: `an illustration of a baby fox in a suit playing guitar`

AI generated images:

[13, 14]

Creating Images from Text

Midjourney generations over time: “a hyper-realistic image of Harry Potter”
Source: Midjourney, 2024

Figure 2.3.6

Creating Videos from Text

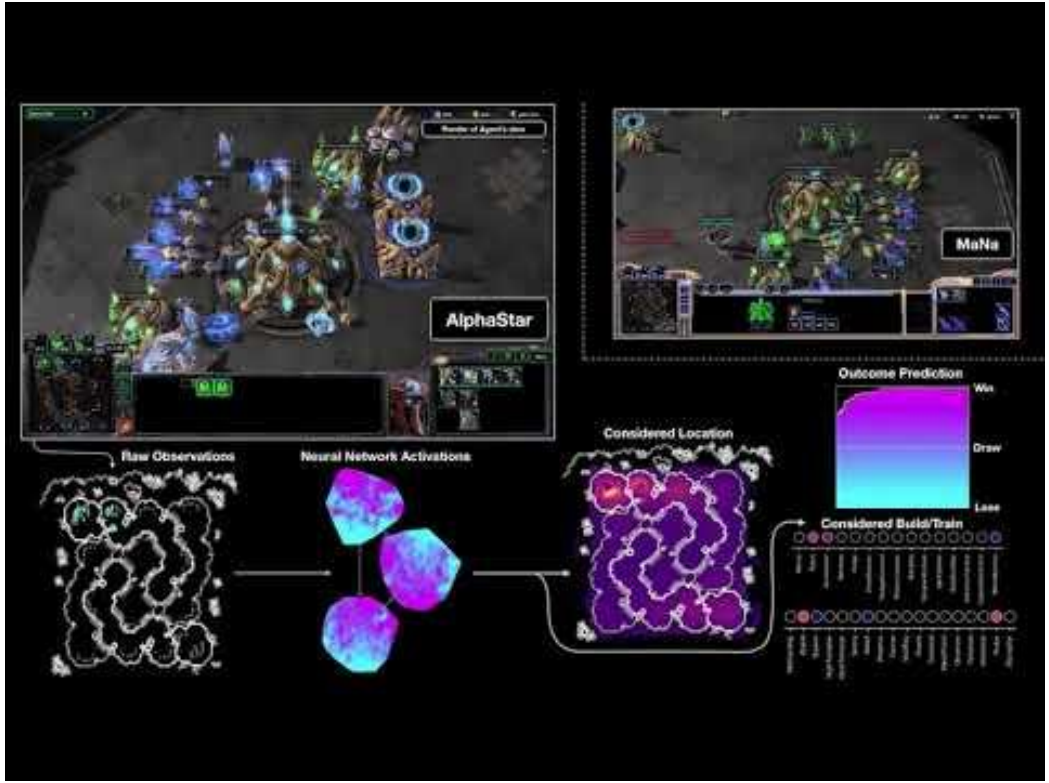
Text Prompt: `A medium shot, historical adventure setting: Warm lamplight illuminates a cartographer in a cluttered study, poring over an ancient, sprawling map spread across a large table. Cartographer: "According to this old sea chart, the lost island isn't myth! We must prepare an expedition immediately!"`

OpenAI writes Python Code

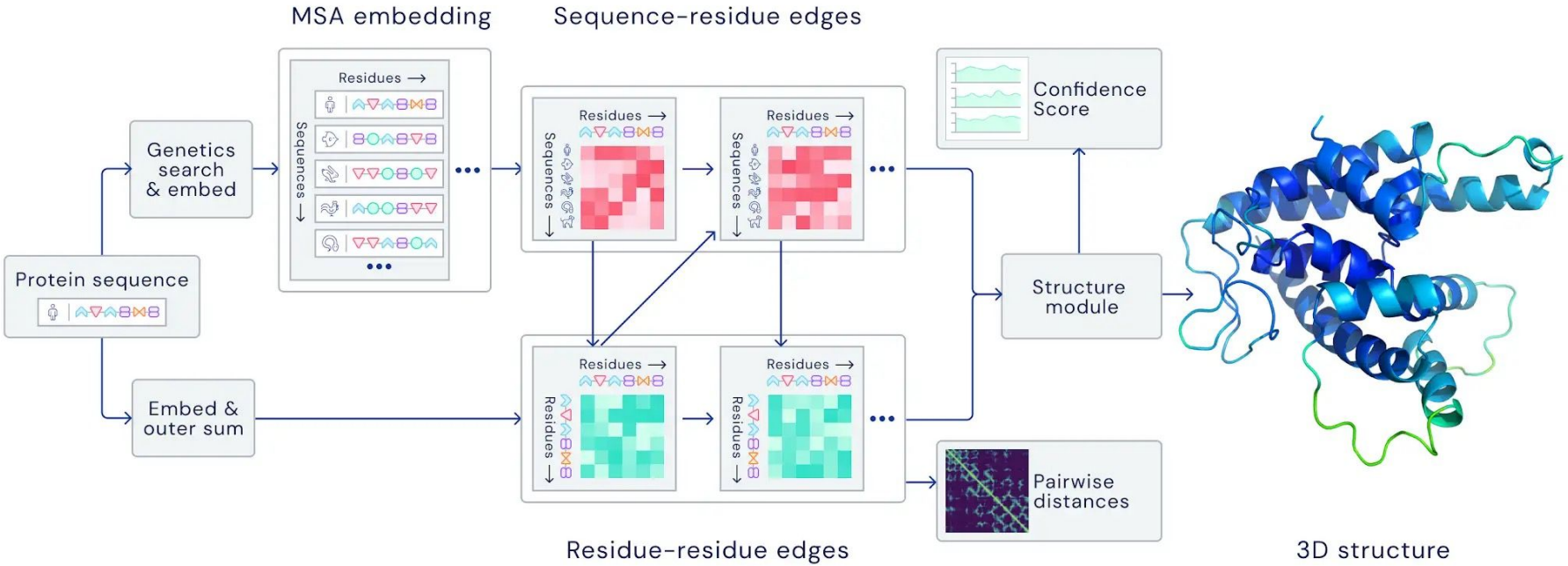
```
    items: List[Item]

    def compute_total_price(self, palindrome_discount=0.2):
        """
        Compute the total price and return it.
        Apply a discount to items whose names are palindromes.
        """
        total_price = 0
        for item in self.items:
            if is_palindrome(item.name):
                total_price += item.price * (1 - palindrome_discount)
            else:
                total_price += item.price
        return total_price

    def print_receipt(self):
        """Print the total price and the price of each item"""
        print("Total price: {:.2f}".format(self.compute_total_price()))
        for item in self.items:
            print("{:>10}: {:.2f}".format(item.name, item.price))
```

[7, 8, 15]

Deep Mind plays Star Craft II



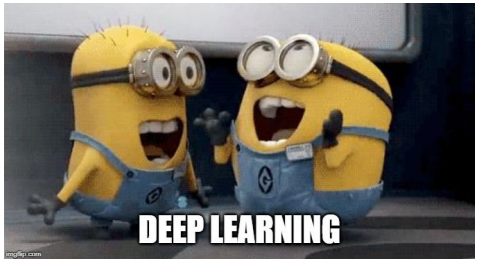
AlphaFold folds Proteins



[17]

Summary

- Machine Learning can be an alternative to imperative programming
- Machine Learning = Using data to answer questions
- Deep Learning can do pretty cool stuff



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4. Ramesh et al. Zero-Shot Text-to-Image Generation, 2021
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Fig-3. Bagel vs. Muffin: https://www.boredpanda.com/dog-food-comparison-bagel-muffin-lookalike-teenybiscuit-karen-zack