# Introduction to AI and ML

## Lecture 1

Presented by Alex Goodall

September 27, 2024

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- Moved back to the UK for Uni
- I studied computer science for 3 years at Durham and 1 year at Oxford.
- Now I am doing a PhD in AI at Imperial!

# Where we're at with AI

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**Figure:** ChatGPT

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**Figure:** AI generated art (DALLE-2)

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- Deep fakes (both images and video now!).

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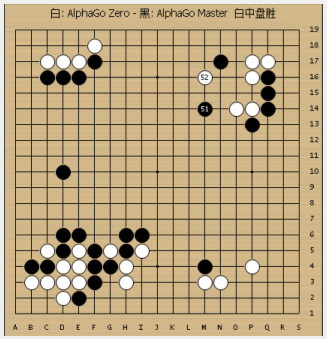


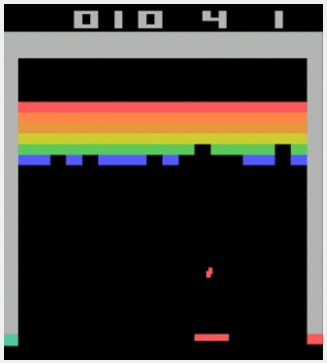

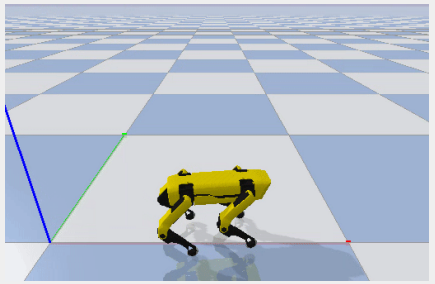

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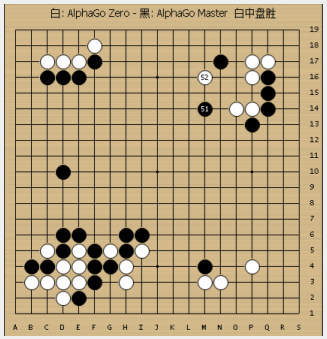


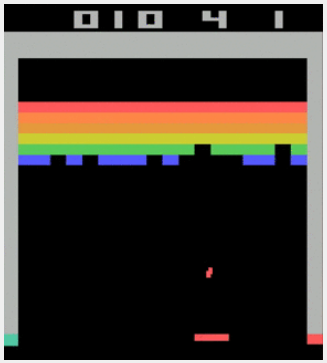

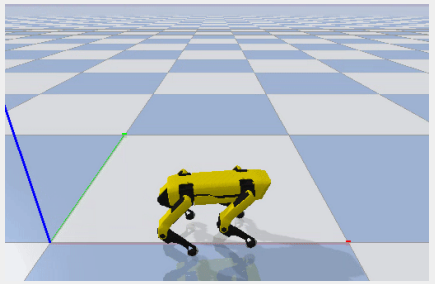

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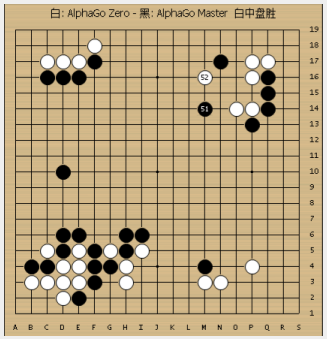


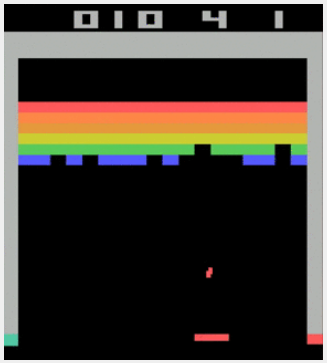

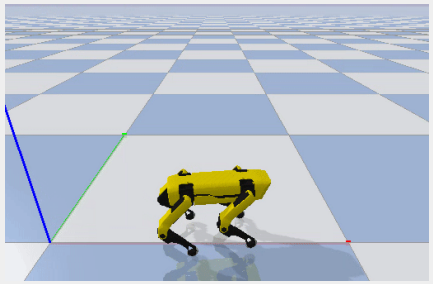

- Reinforcement learning is also used to train LLMs (like ChatGPT).
- My goal is to think about how we can be sure that AI systems trained with RL don’t do anything ‘unsafe’ – think self driving cars, robots etc.

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- The course is structured in 26 weeks of teaching, which includes a approx. 1 hour lecture 5-10 minute break, then 1 hour of coding/practical exercises.
- We will be using python for all of our programming, so if you have experience then great! If not don't worry!

# How the course is going to be delivered

- I will delivery the course through a public GitHub repository:
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- This will be updated every week with, slides, (possibly) lecture notes and coding exercises.
- You can download everything via the GitHub website. Or if you've used git before you can "'git clone"' the repository.

# Course content (first 5-6 weeks)

- Week 1: Introduction to the course, setup and basic Python programming
- Week 2-3: Fundamentals of linear algebra, vector spaces, multiplication, transposition, linear transformations, matrix inverse, determinant, eigenvalues, eigenvectors.
- Week 4-5: Fundamentals of probability theory, events outcomes, random variables, basic probability distributions, conditional probability, Bayes' Theorem, independence, expectation, variance, covariance, correlation, discrete and continuous variables.
- Week 5-6: Fundamentals of multivariate calculus, functions of multiple variables, partial derivatives and gradients, gradient descent, critical points and Hessian matrix.

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- First I am going to try and assess your mathematical background and programming background so I can plan the next few weeks.

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- Then we are going to setup python on your devices and get started with this first weeks programming exercises.

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- Linear algebra: vectors, matrices, matrix multiplication, matrix inverse?
- Probability theory: sample space, events and outcomes, Bernoulli distribution, Binomial distribution, Gaussian (normal) distribution, expectation/mean, variance, correlation, discrete v.s. continuous random variables?
- Calculus: simple derivatives (e.g. $d(x^2) = 2x$, $d(e^x) = e^x$), chain rule ($d(e^{x^2}) = 2x \cdot e^{x^2}$)?

# Programming background

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- Basic control flow: if statement, foor loop, while loop?
- Basic data-structures: lists, tuples, dictionaries?

# Getting started

- Go to `https://github.com/sacktock/26-week-ML-public` and scroll down to **Installation and setup instructions**
- Download Anaconda `https://www.anaconda.com/download/success`
- Open your terminal (Mac) or cmd (Windows) and follow the instructions.
- Download ‘basics.ipynb‘ and ‘exercises.ipynb‘ from `https://github.com/sacktock/26-week-ML-public/tree/main/week-1`.
- Run ‘jupyter notebook’ in your terminal (Mac) or cmd (Windows) to start coding!

# References