LECTURE 31

CRASH COURSE ON MACHINE LEARNING

MCS 275 Spring 2022
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LECTURE 31: CRASH COURSE ON MACHINE LEARNING

Course bulletins:

- Watch video for lecture 30
- No in-person meeting on Friday - watch video for lecture 32 by end of Friday.
- Professor Dumas returns on Monday 4 April

BEFORE I SAY ANYTHING...

WHAT DOES THE PHRASE "MACHINE LEARNING" MAKE YOU THINK OF?

CONTENTS

- What is machine learning?

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- What is machine learning?
- What are some examples of machine learning?

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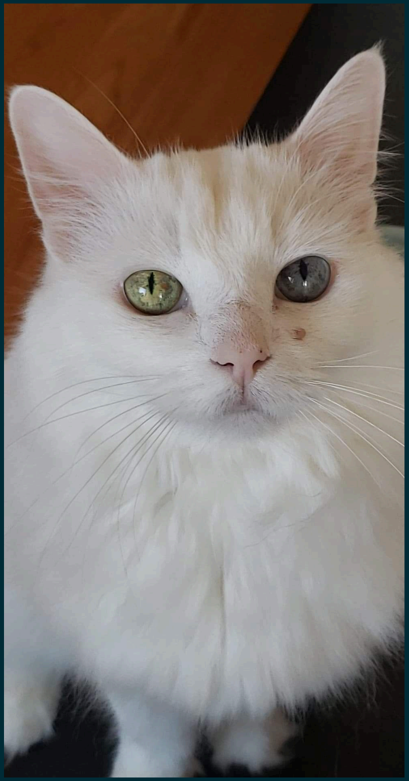
- What are some examples of machine learning?
- How can you get into machine learning?

WHAT IS MACHINE LEARNING?

"The study of computer algorithms that can improve automatically through experience and by the use of data." - Wikipedia

MOTIVATION: DOG OR CAT?



How do we write a program to find out whether an image of is a dog or a cat?

MAIN TYPES OF MACHINE LEARNING:

Supervised learning — Data is *labeled*.

Unsupervised learning — Data is not labeled.

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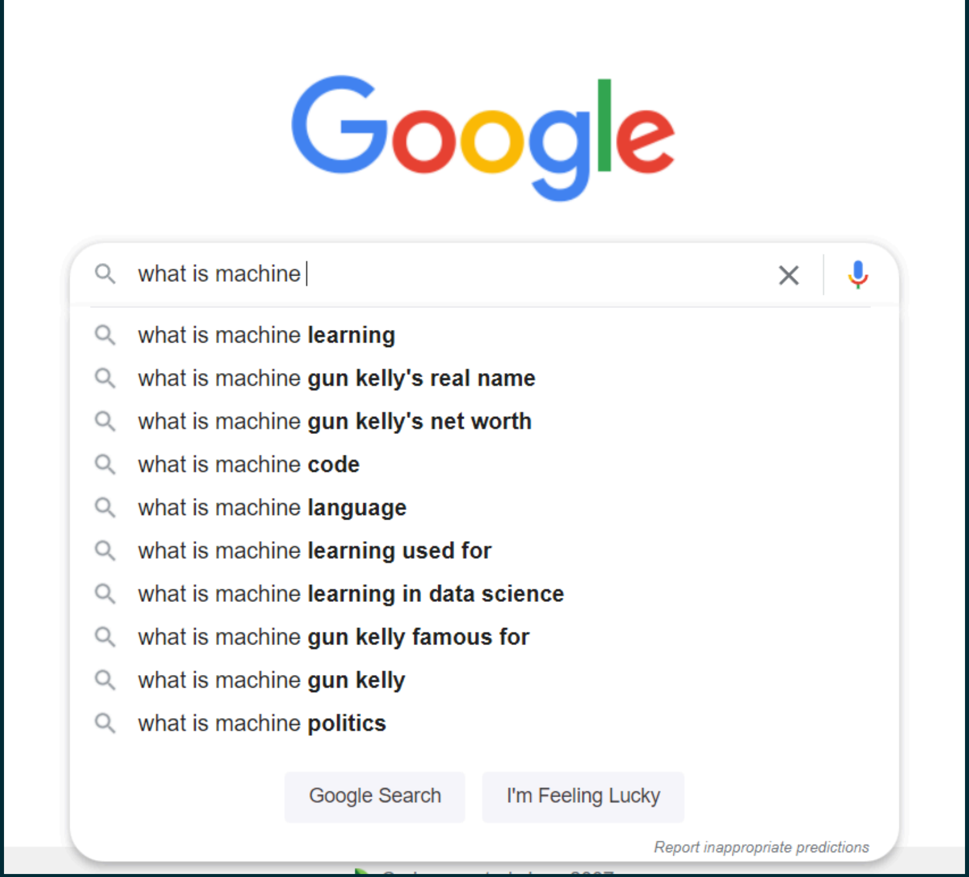
We'll focus on supervised and unsupervised learning.

QUICK EXAMPLES (UNSUPERVISED):

- **Recommendation systems** (e.g. Google search, YouTube/TikTok suggestions, Amazon suggestions)



what is machine

what is machine **learning**

what is machine **gun kelly's real name**

what is machine **gun kelly's net worth**

what is machine **code**

what is machine **language**

what is machine **learning used for**

what is machine **learning in data science**

what is machine **gun kelly famous for**

what is machine **gun kelly**

what is machine **politics**

QUICK EXAMPLES (UNSUPERVISED):

- **Dimensionality reduction** — Making data have fewer dimensions without losing its "meaning".

QUICK EXAMPLES (UNSUPERVISED):

- **Clustering** — Finding suitable groups for unlabeled data.

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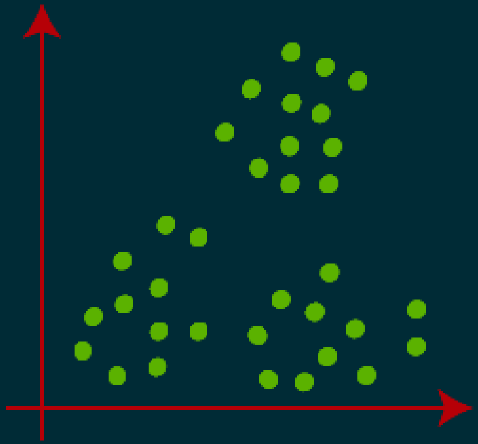
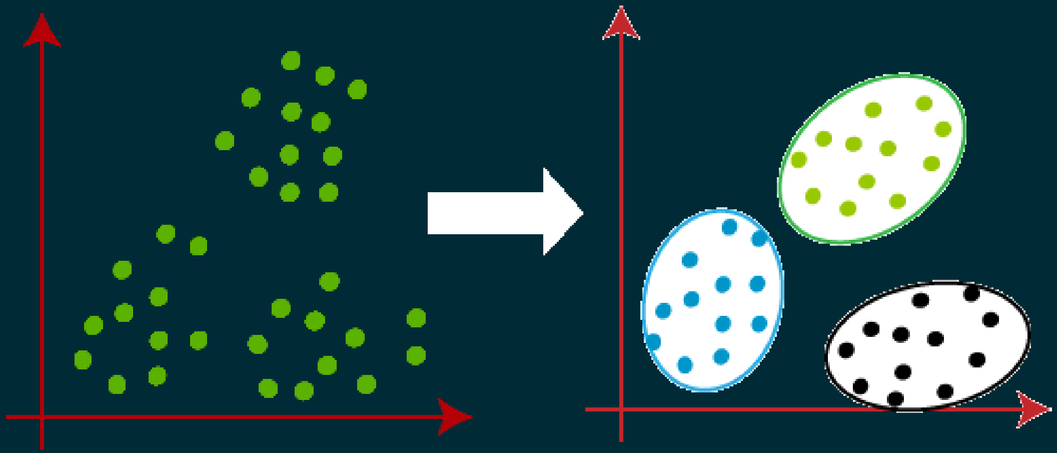


QUICK EXAMPLES (UNSUPERVISED):

- **Clustering** — Finding suitable groups for unlabeled data.



QUICK EXAMPLES (SUPERVISED):

Classification — Assigning labels to data with labeled *categories*. E.g. is an image a dog or a cat?

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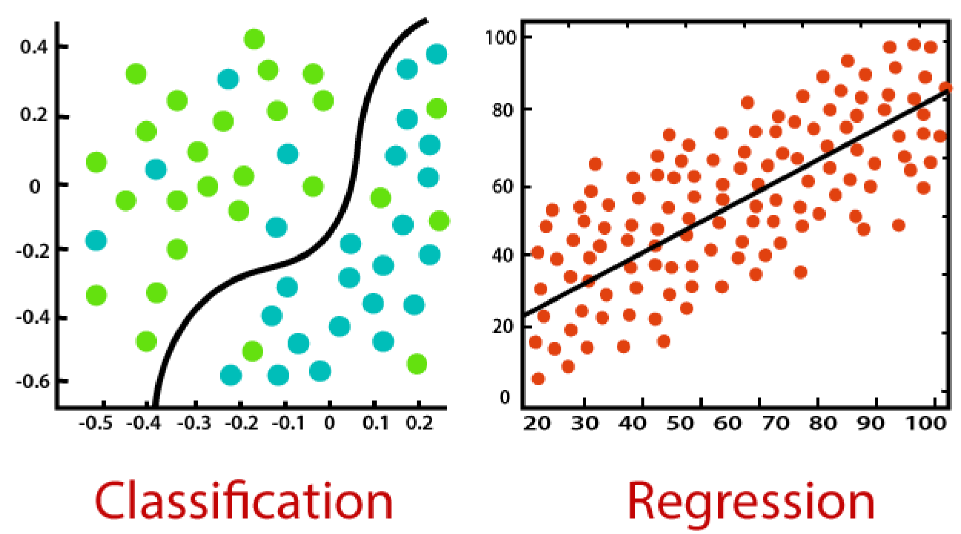
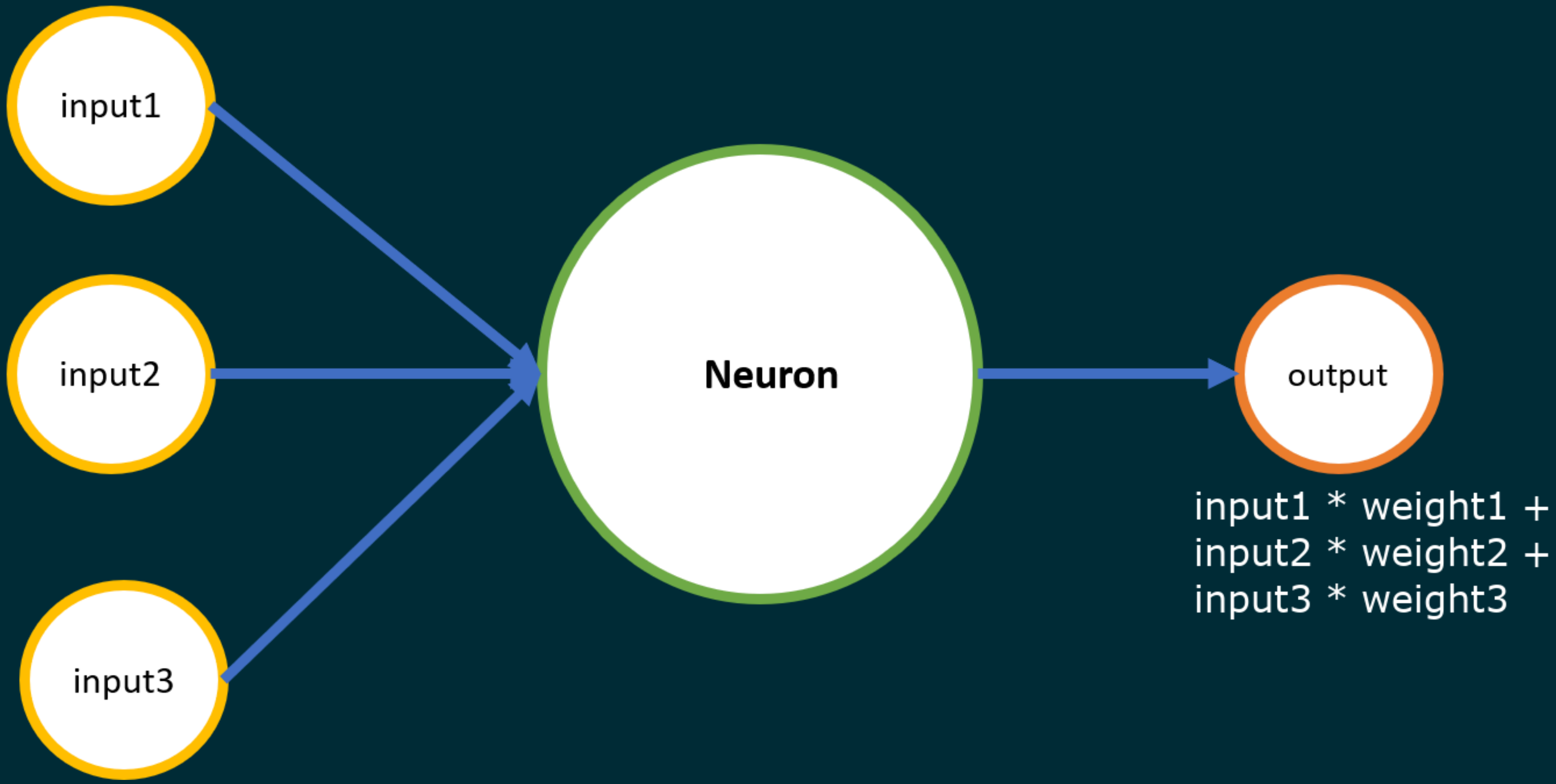


Classification

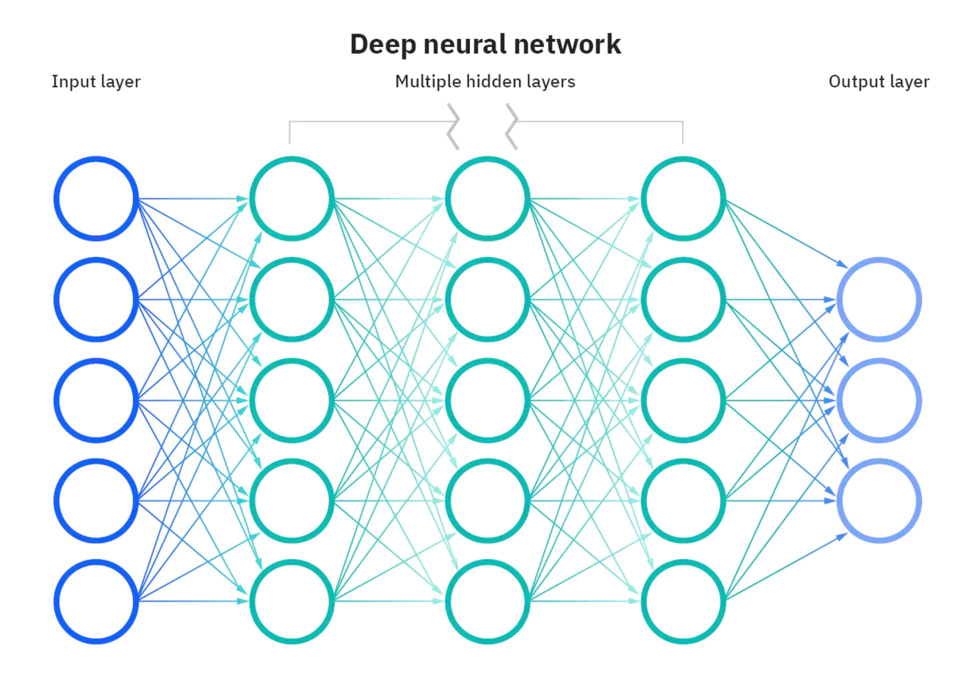
Regression

Let's define something called a "**neuron**":



input1 * weight1 +
input2 * weight2 +
input3 * weight3

NEURAL NETWORKS



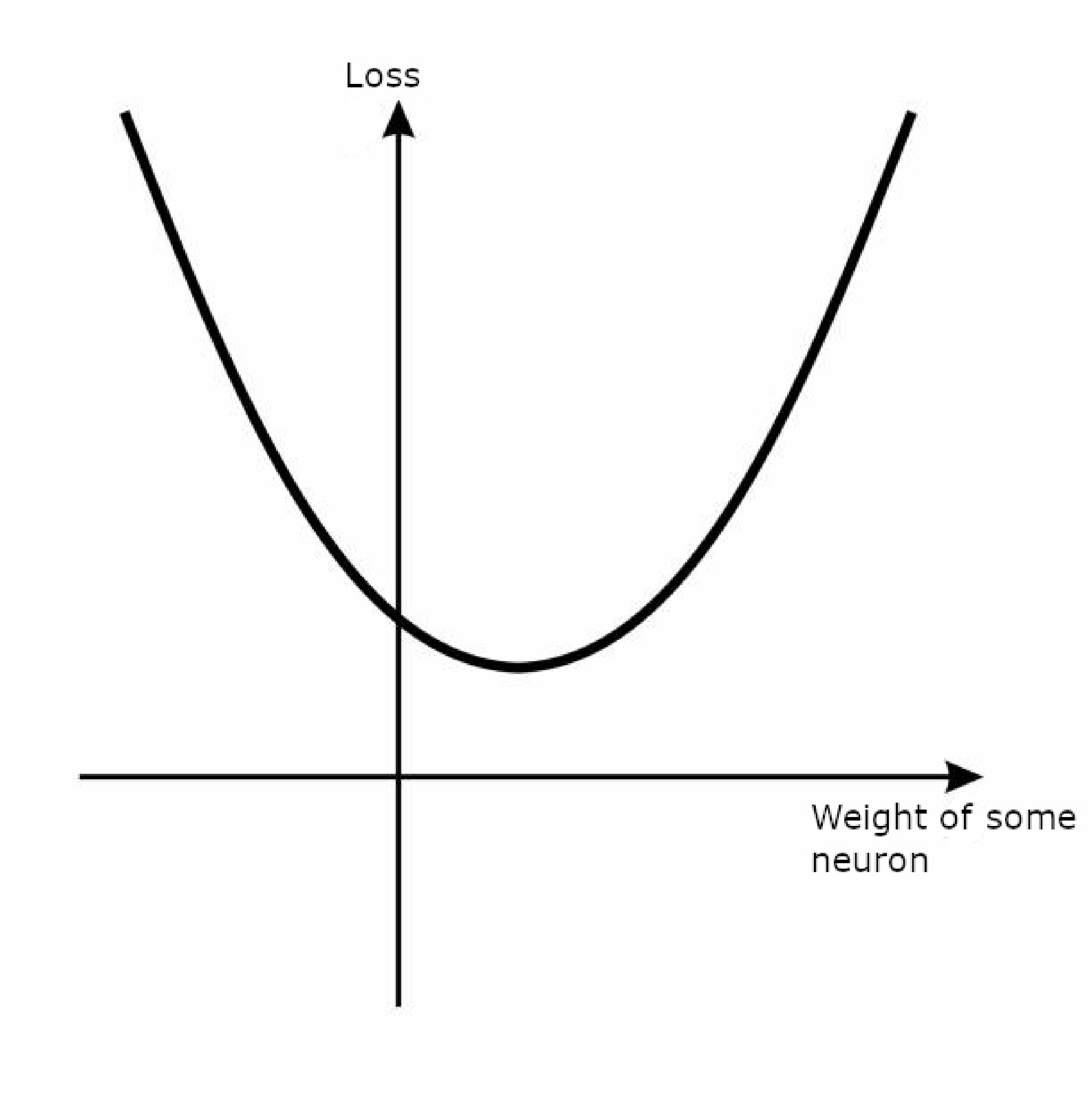
Source: IBM

They are a huge collection of "neurons", inspired by the brain.

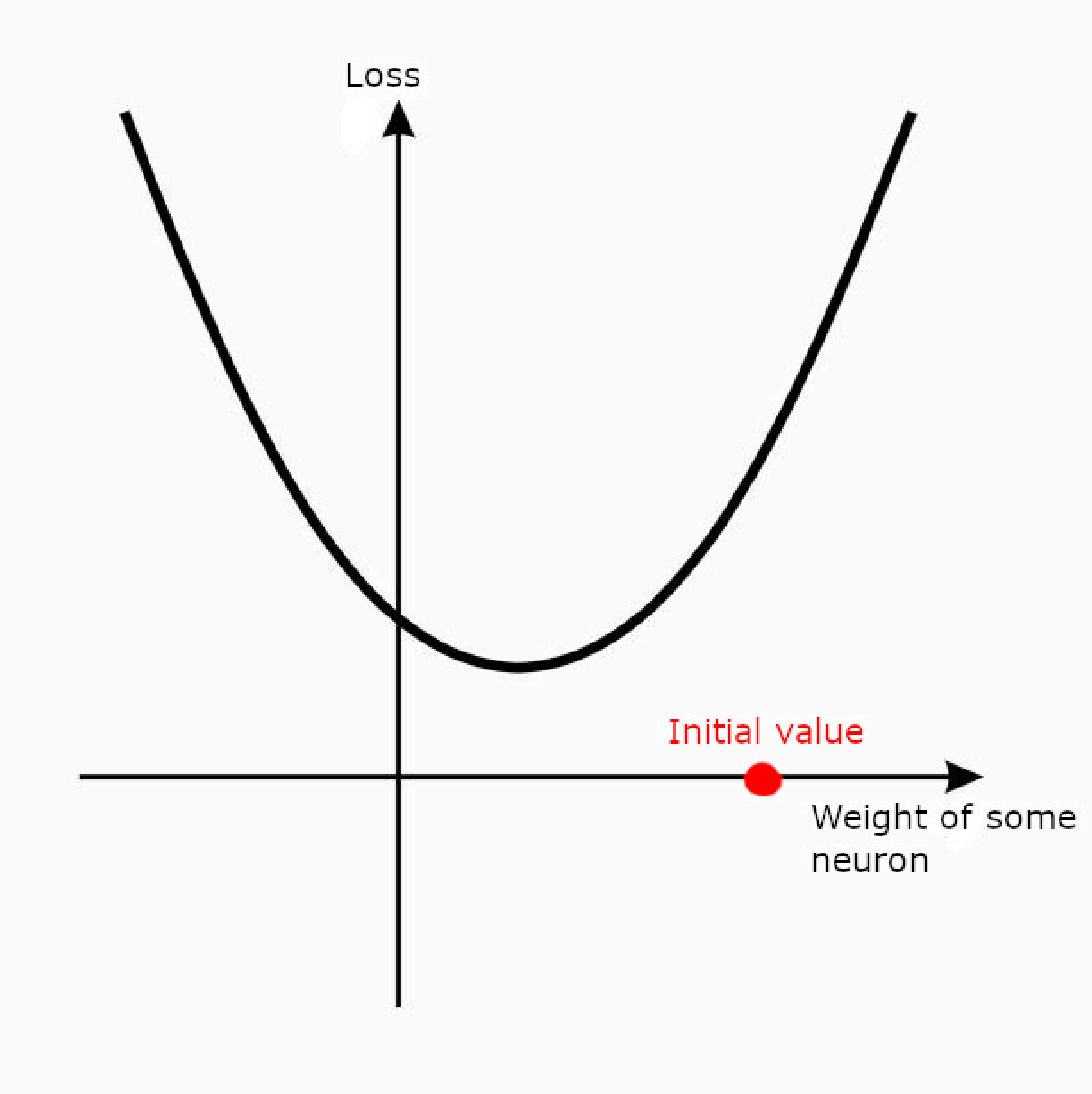
LOSS FUNCTION

- We can have a function to characterize how "far" our model's prediction is from the true value.
- Then we can use calculus to find the values of the weight that make this as small as possible.

Loss function — Characterizes how "far" our model's predictions are from the true answers



Loss function — Characterizes how "far" our model's predictions are from the true answers



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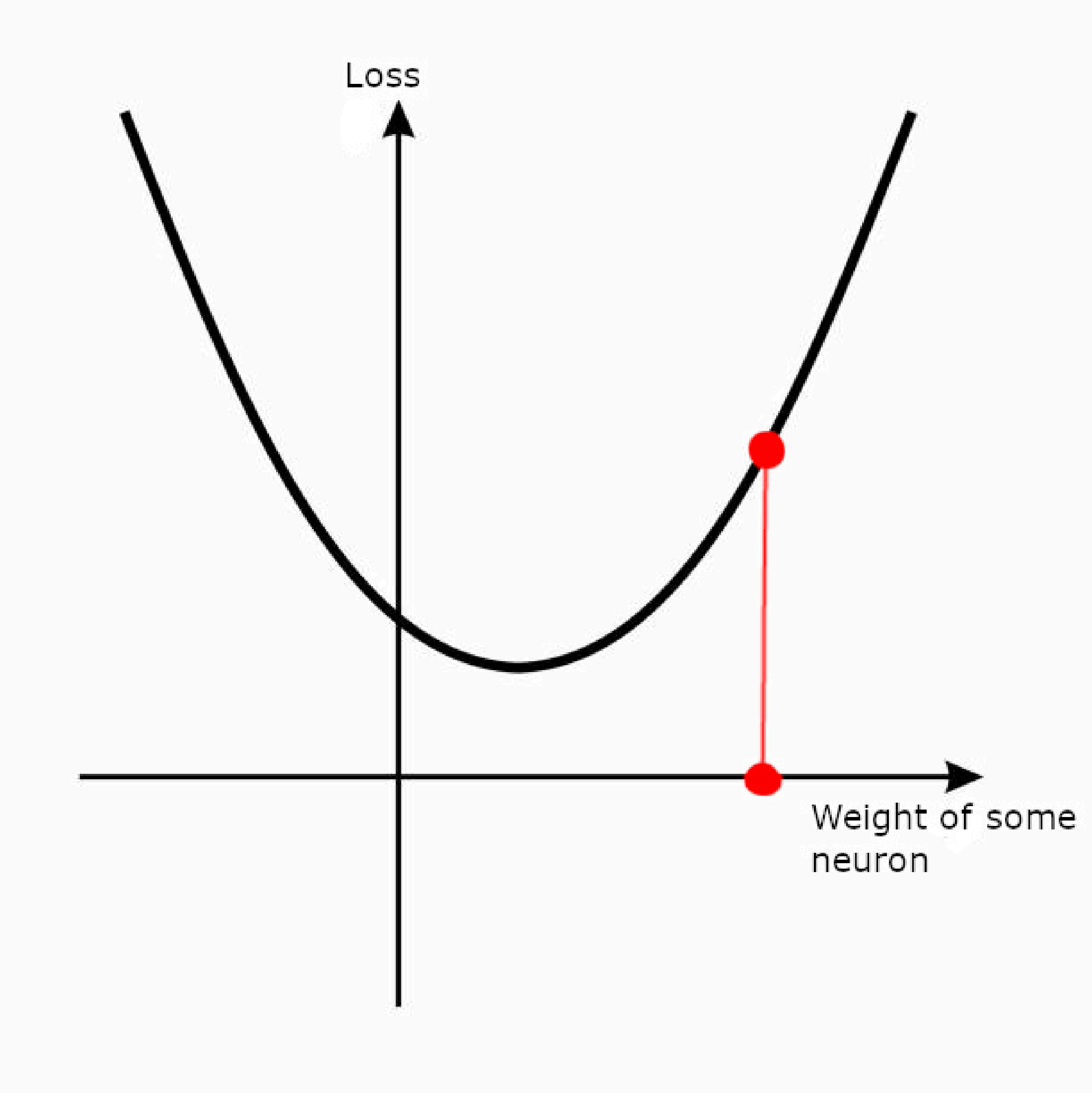

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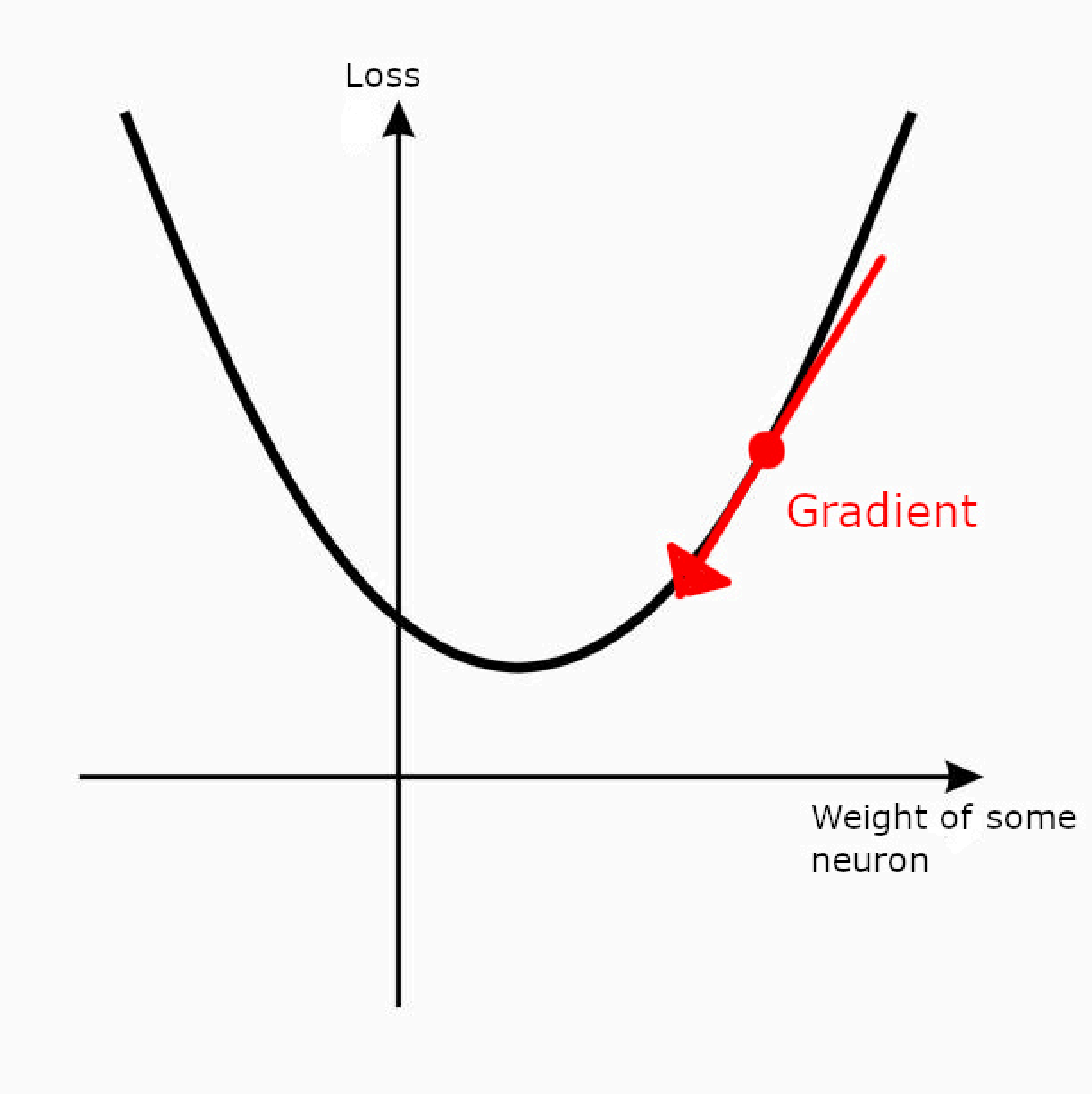

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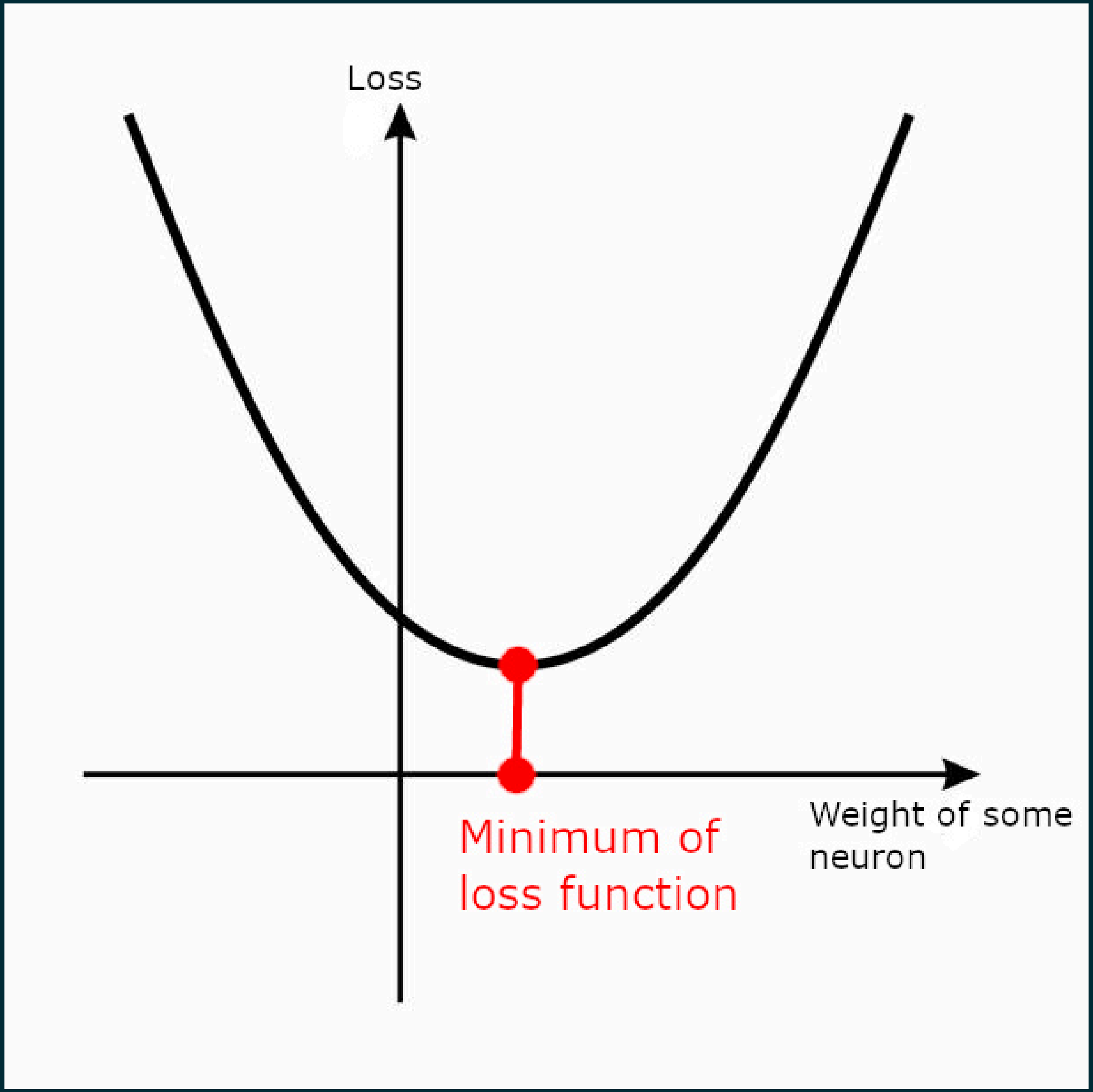

LET'S TRY IT

→ Jupyter notebook ←

HOW CAN YOU DO MACHINE LEARNING WITH PYTHON?

- **scikit-learn** (simplest) — Good for general machine learning or quick implementations.
- **PyTorch** — Good for deep learning.
- **TensorFlow** — Good for deep learning.

WHAT TOOLS HELP WITH MACHINE LEARNING?

- Python programming
- Linear algebra
- Calculus
- Statistics

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CLASSES AT UIC RELATING TO MACHINE LEARNING

- **MCS 548** — Mathematical Theory of Artificial Intelligence,
- **CS 411** — Artificial Intelligence I,
- **CS 412** — Introduction to Machine Learning

SUMMARY

- We saw the main types of machine learning (supervised, unsupervised, and reinforcement)
- We saw brief examples of supervised/unsupervised learning
- We saw neural networks and built one in scikit-learn

INTERESTING RELATED LINKS

- 3Blue1Brown on YouTube: video series on neural networks
- Towards Data Science: Types of machine learning
- Machine Learning Mastery: Your first machine learning project in Python step-by-step