

CS 3120 / IS 3117 / SCS 3201

Machine Learning and Neural Computing

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Lecturers

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Class Demography

**Science
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**IS
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**CS
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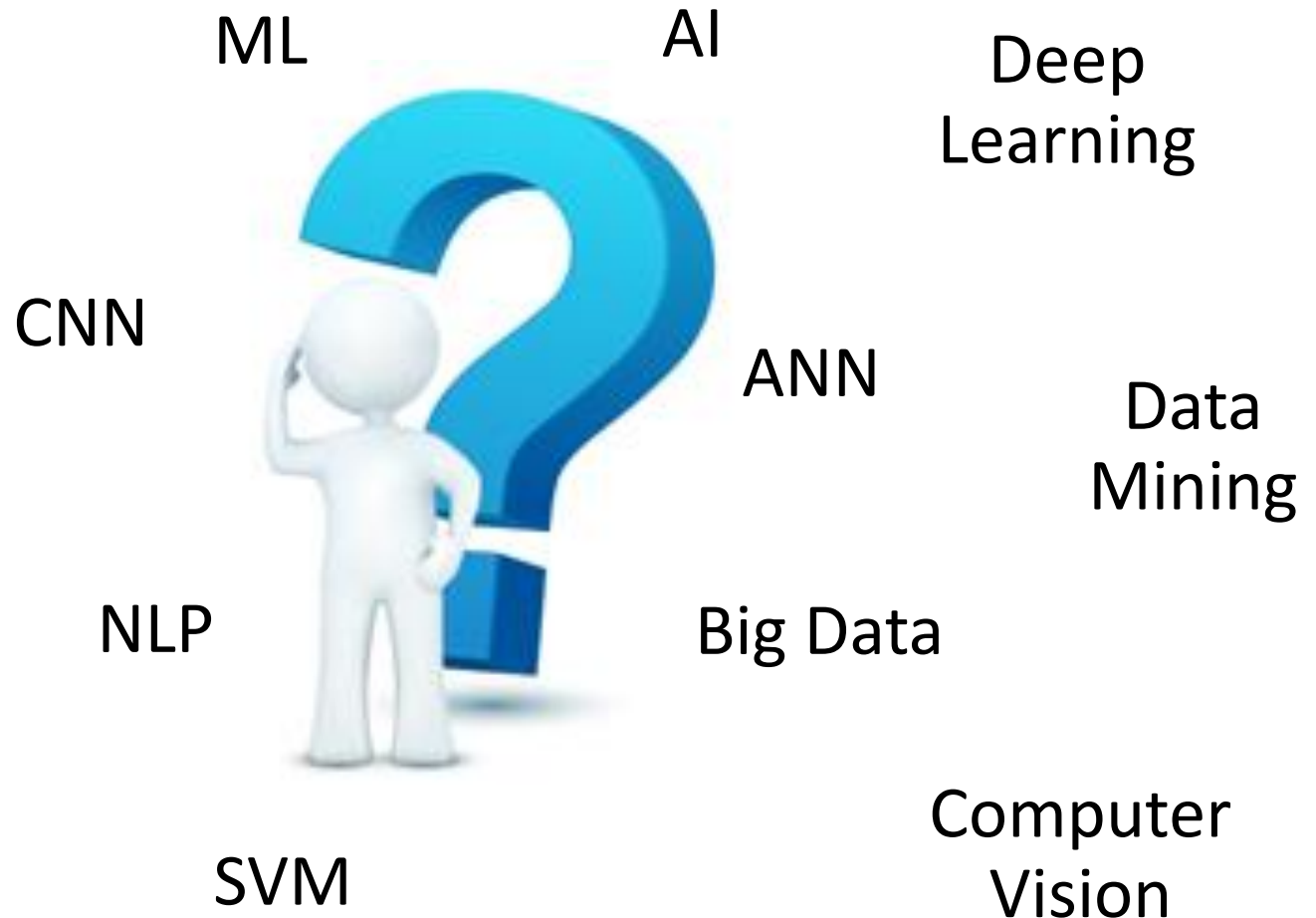
Prerequisites

- Linear Algebra
- Calculus

Introduction

- Machine Learning
 - Learning Problem
-

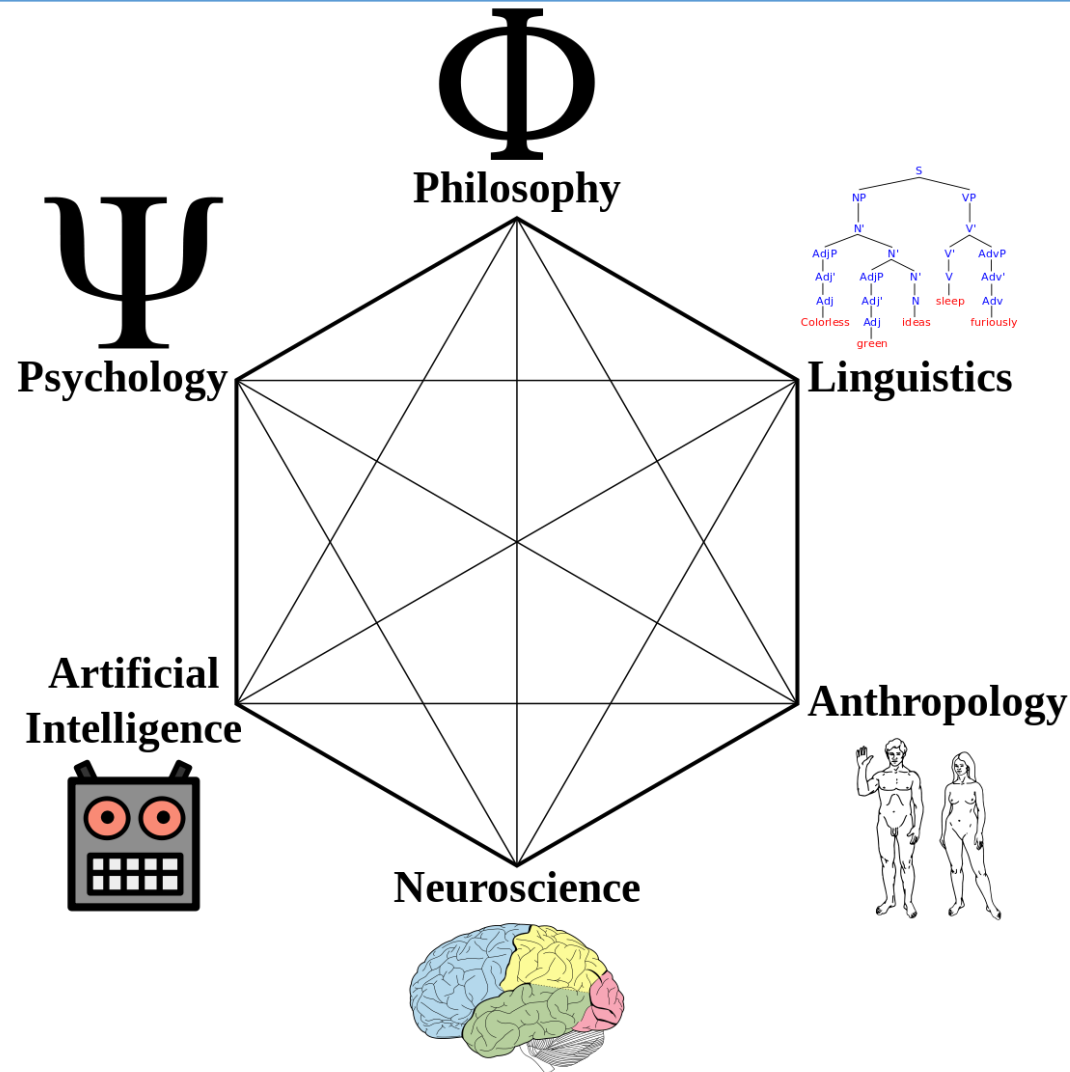
Where are we ?



Cognitive Science ~ Wikipedia

- **Cognitive science** is the interdisciplinary, scientific study of the mind and its processes. It examines the nature, the tasks, and the functions of cognition (in a broad sense).
- Cognitive scientists study intelligence and behavior, with a focus on how nervous systems represent, process, and transform information. Mental faculties of concern to cognitive scientists include language, perception, memory, attention, reasoning, and emotion; to understand these faculties, cognitive scientists borrow from fields such as linguistics, psychology, artificial intelligence, philosophy, neuroscience, and anthropology.

Cognitive Science



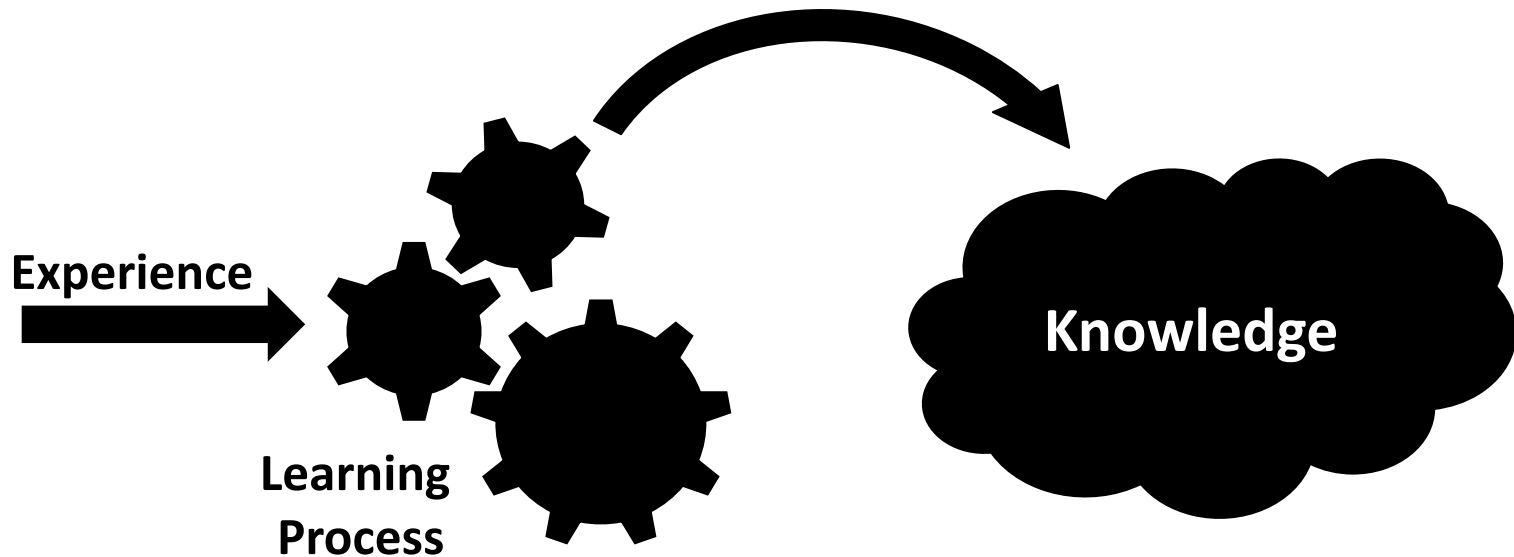
“ - Jeff Hawkins - ”



The brain uses vast amounts of memory to create a model of the world. Everything you know and have learned is stored in this model. The brain uses this memory-based model to make continuous predictions of future events. **It is the ability to make predictions about the future that is the crux of intelligence.**

Intelligence and Learning

- Intelligence is the ability to learn from experience, solve problems, and use our knowledge to adapt to new situations.



Machine Learning

“Machine learning (ML) is the study of algorithms and statistical models that computer systems use to progressively improve their performance on a specific task.”

~ Wikipedia

- Learning in Artificial Context
- Data resembles the experience
- Computational Models to represent Knowledge

Tom Mitchell (1998)

A computer program is said to *learn* from experience E with respect to some task T and some performance measure P , if its performance on T , as measured by P , improves with experience E .

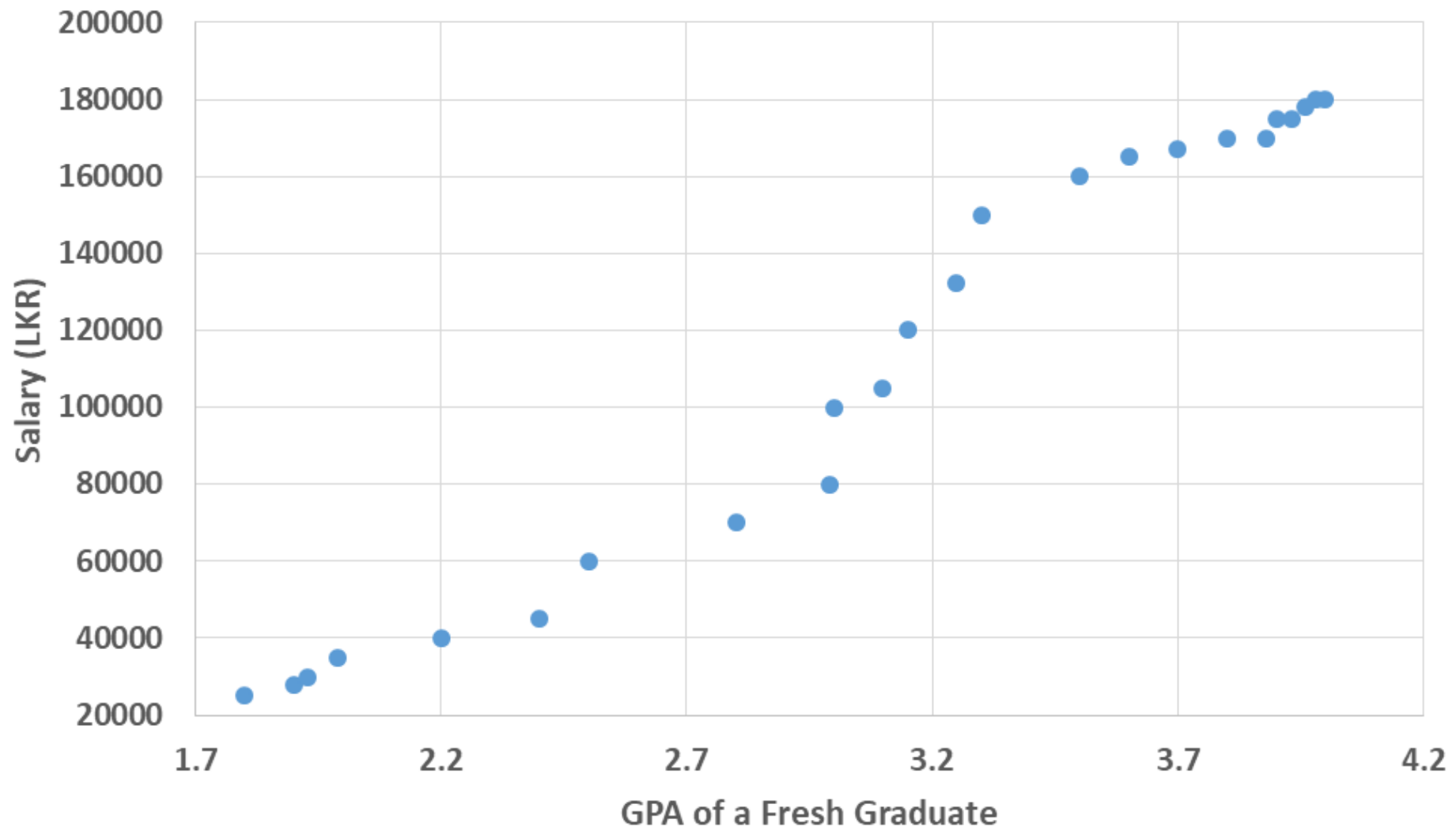
Ex.

- E – Emails
- T – Recognizing spams
- P – Accuracy of spam email recognition

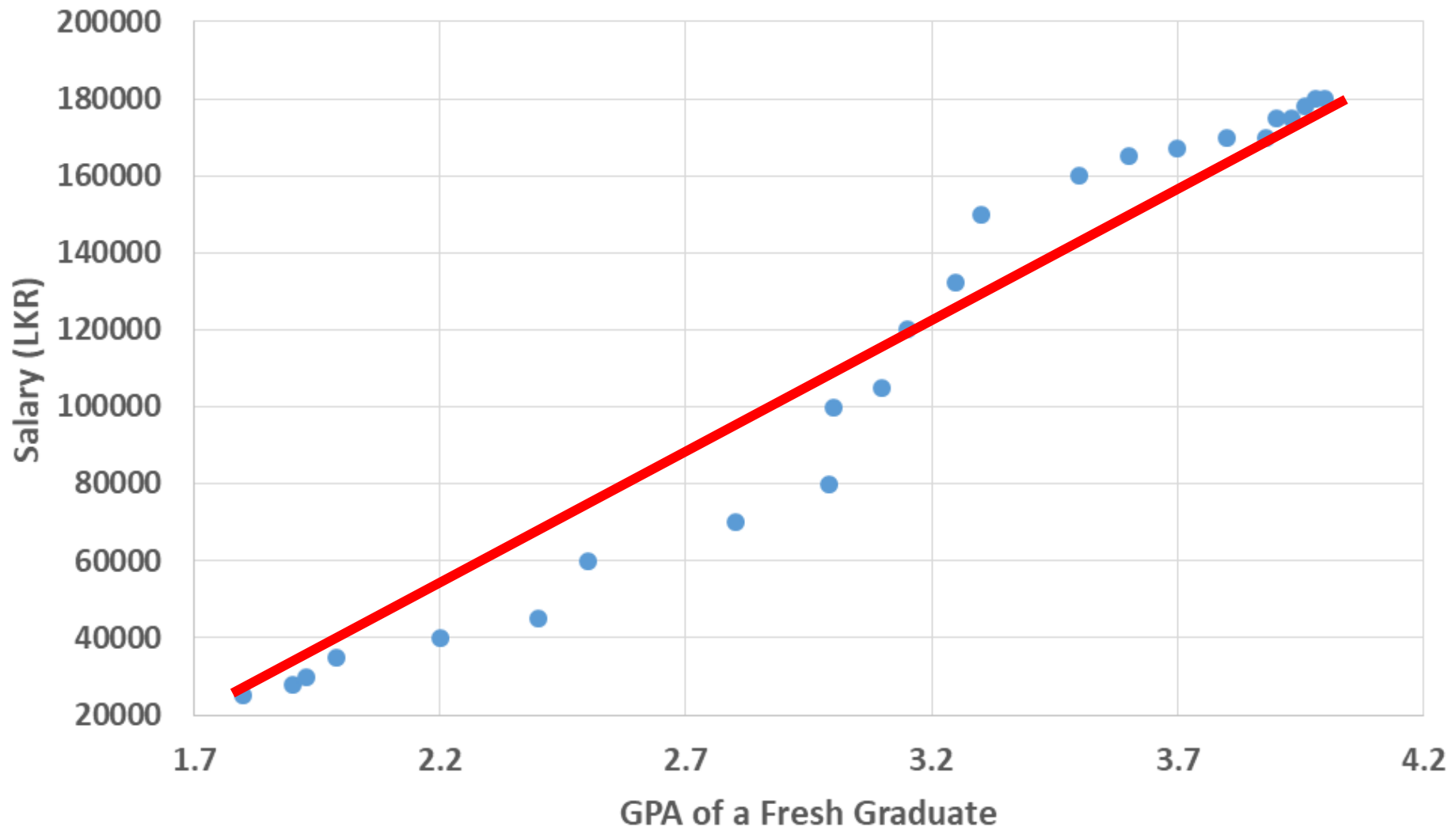
Machine Learning

- Applications
 - Search Engines – Appropriate results
 - Mail services – Spam filters
 - Handwritten character recognition
 - Recommendations
 - Word suggestions in Keyboards
 - Robots / Autonomous Vehicles
 - Natural Language Processing

Example – Fresh graduates' Salary



Example – Fresh graduates' Salary



Understanding the Example

What is ?

- Learning
- Intelligence

What if ?

- Complex data

Complex Data

- Single data item with multiple attributes

- Ex. -

- Student

Age	Sex	Province	District	Program	GPA	Crazy
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- Animal

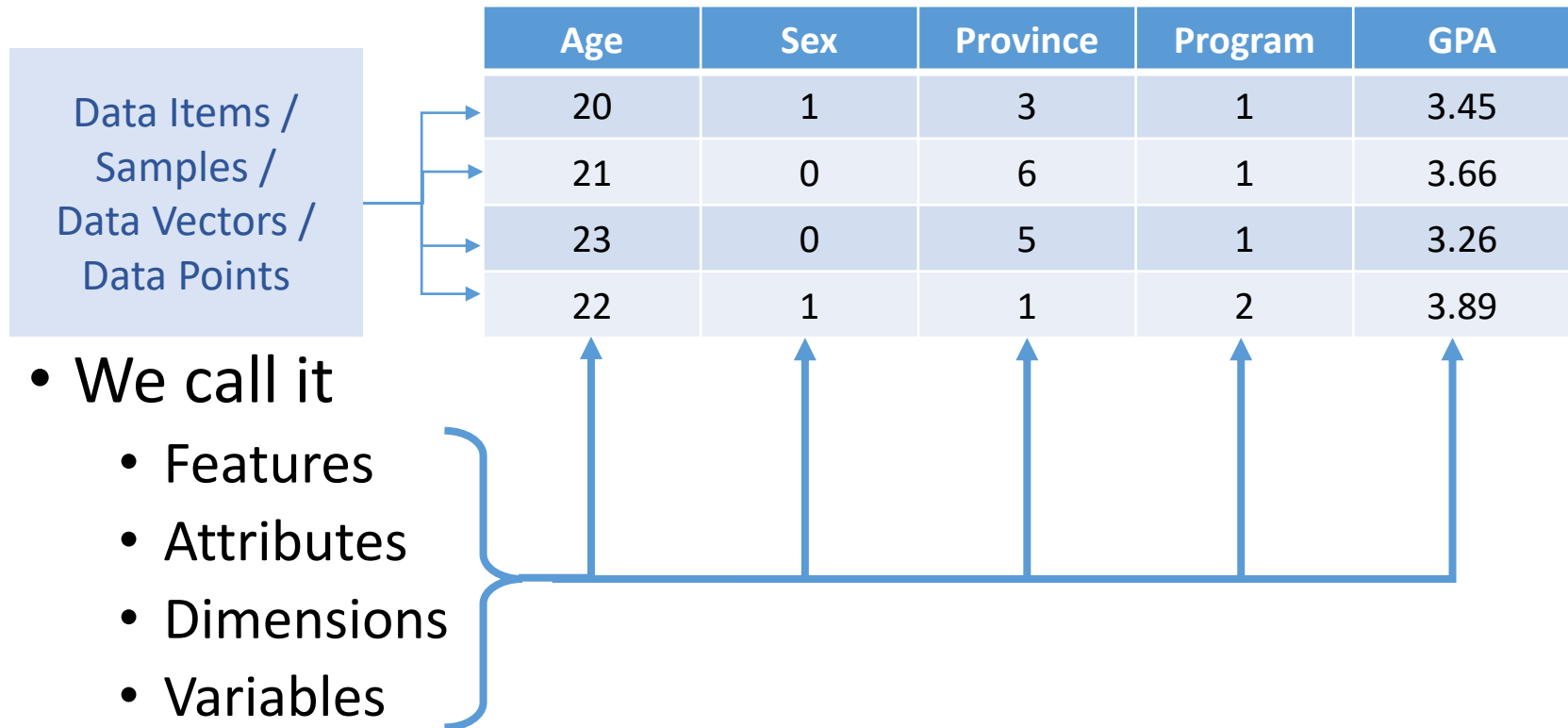
Legs	Beak	Feathers	Mammal	Eggs	Fly	Predator
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- We call it

- Samples
 - Data Points
 - Data Vectors
 - Data Items

Data

- Data set



Input Matrix

20	1	3	1	3.45
21	0	6	1	3.66
23	0	5	1	3.26
22	1	1	2	3.89

Machine Learning Algorithms

- Predictions/ Forecast
- Anomaly detections
- Clustering
- Pattern recognition

Machine Learning Algorithms

Two main broader classes

1. Supervised Learning
2. Unsupervised Learning
3. Semi-Supervised
4. Reinforcement Learning

Supervised Learning

Algorithm learns to map a given input to a desired output, so it can map an unforeseen input to an output.

- Spam filters
- Handwritten character recognition
- Credit limit

Supervised Learning Problems

- Regression Problems
 - Real Valued Output
- Classification Problems
 - Categorical / Discrete Output

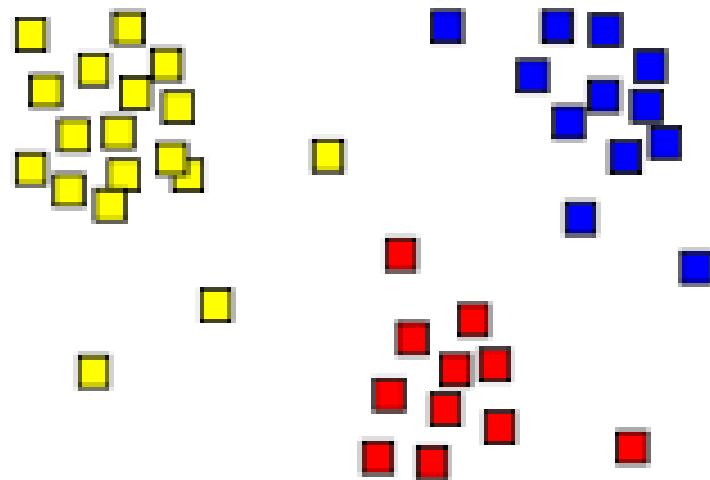
Classification or Regression ?

- Predicting the salary of a fresh graduate
- Email – Spam or Not
- Tumor – Cancer or Not
- Handwritten character recognition
- Predicting weather – Sunny, Rainy, Cloudy, Windy

Unsupervised Learning

Algorithm learns without having desired output for a given input. It just attempts to find out the structure within the data set (identify similarities and divisions among data).

- Clustering



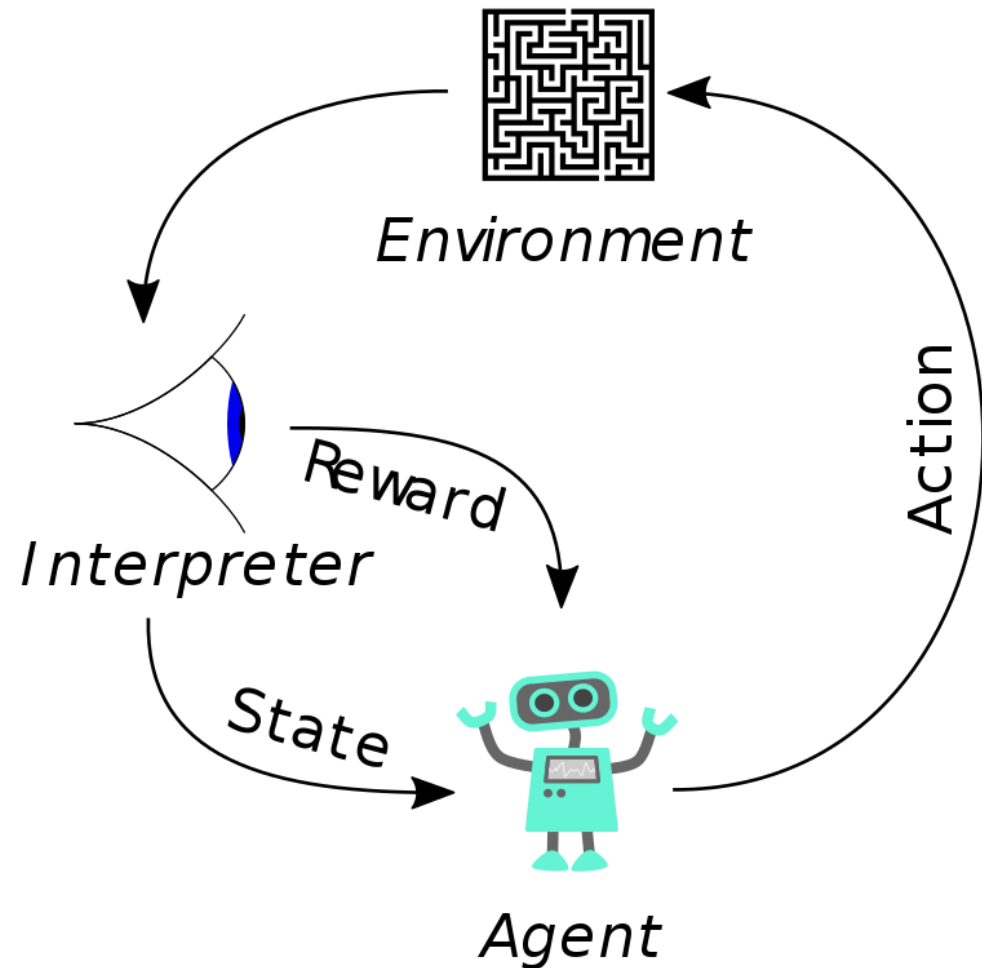
Semi-supervised Learning

- Part of the data is with desired output and the rest is without desired output.

Read More...

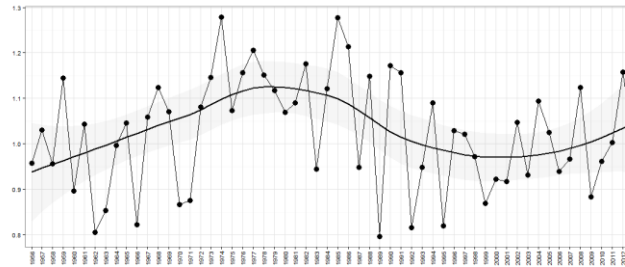
Reinforcement Learning

Read More...



The Essence of Machine Learning

- A pattern in data
- No mathematical way to solve
- Data available



Q & A

Thank you..!
