

MACHINE LEARNING

اَللّٰهُمَّ ارْزُقْنِيْ عِلْمًا نَّافِعًا وَاسِعًا عَمِيْقًا

اَللّٰهُمَّ ارْزُقْنِيْ رِزْقًا وَّاسِعًا حَلَالًا طَيِّبًا
مُّبَارَكًا مِّنْ عِنْدِكَ

WEEK 02

WHAT IS CONSCIOUSNESS

WHAT IS INTELLIGENCE

WHAT IS ARTIFICIAL INTELLIGENCE

WHAT IS LEARNING

WHAT IS MACHINE LEARNING

ARTIFICIAL INTELLIGENCE VS MACHINE LEARNING

SHOULD I TAKE THIS CLASS ?

A COMMON QUESTION

DETAIL COURSE OUTLINE TODAY

WHAT ARE MY PLAN ?

■ In Class

- Discuss a Machine learning Algorithm
- Do the relevant Mathematics in Class
- An Example

■ At Home

- Code the Algorithm in Python (do not use APIs)
- Code the Algorithm with API

DECISION POINT 01

- Math Requirements:
 - If you are not comfortable with Linear Algebra and Multivariate Calculus and do not want to learn the MATH do not take the class.
 - If You are comfortable with MATH or keen to learn Linear Algebra and Multivariate Calculus you are welcome.

DECISION POINT 02

- Programming Requirements:
 - If you are not comfortable with **Programming in Python** and do not want to learn **do not take the class.**
 - If You are comfortable with **Programming in Python** or do want to learn it **you are welcome.**

DECISION POINT 03

- Can I manage It
 - 3 hour class means 3 hour class or may be 20 minutes less.
 - 7-8 hour working on assignments
 - Assignments are essential to get pass.
 - In case you ready to learn MATH and PROGRAMMING add extra 10 hours.

DECISION POINT 04

نمبر نہیں لگائے گئے۔



gcvin7n

Machine Learning Spring 2021 A

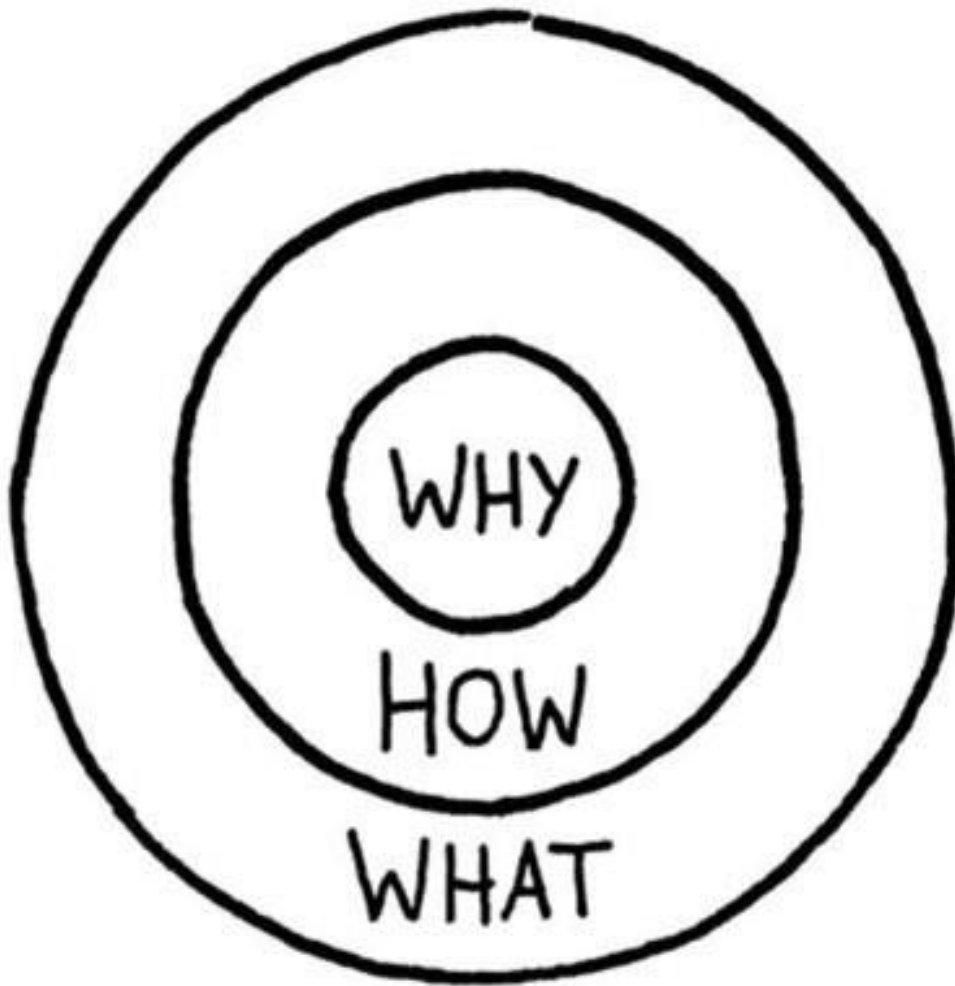


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GOLDEN CIRCLE



Why = The Purpose

What is your cause? What do you believe?

Apple: We believe in challenging the status quo and doing this differently

How = The Process

Specific actions taken to realize the Why.

Apple: Our products are beautifully designed and easy to use

What = The Result

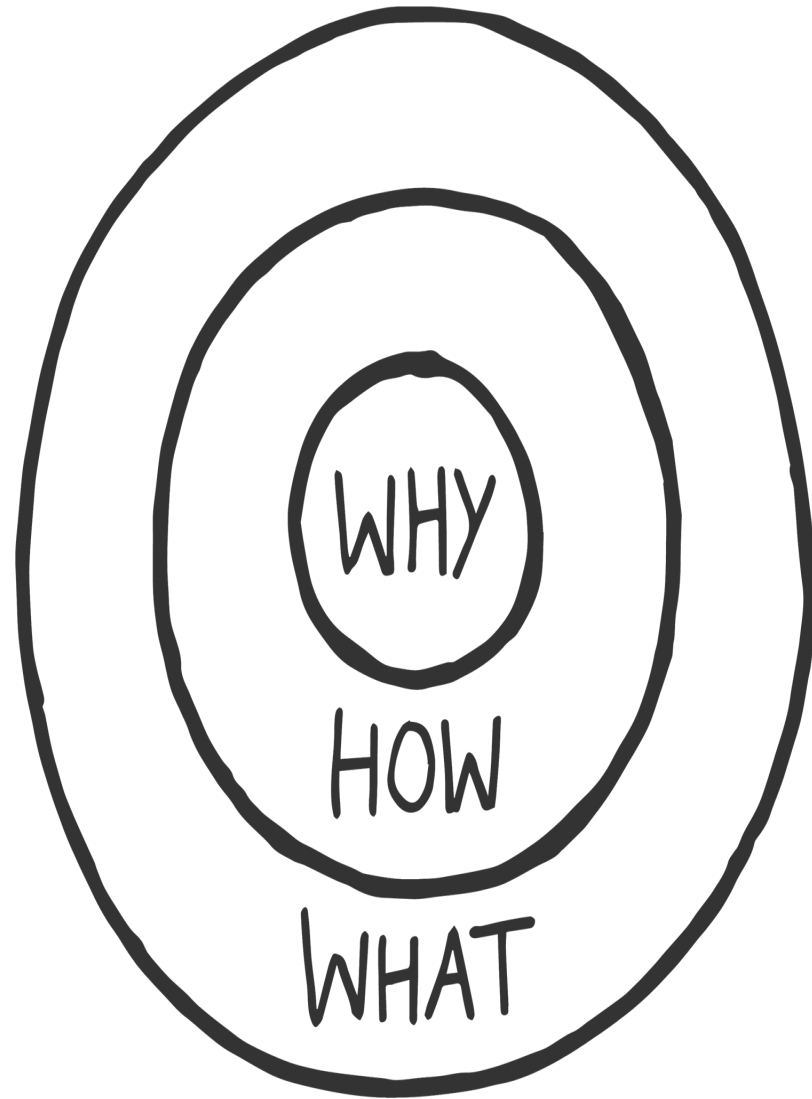
What do you do? The result of Why. Proof.

Apple: We make computers

GOLDEN CIRCLE OF MACHINE LEARNING

WHY

Any idea ?



WHO ARE WE ?

WHAT IS UNIQUE IN US ?

CONSCIOUSNESS

ACTIVITY

- How are you feeling now?
- How you end up here ?
- Why you are here ?

CONSCIOUSNESS

HUMANS HAS CONSCIOUSNESS

FROM WHERE THIS CONSCIOUSNESS CAME

BRAIN IS PHYSICAL THING BUT WHERE IS
CONSCIOUSNESS

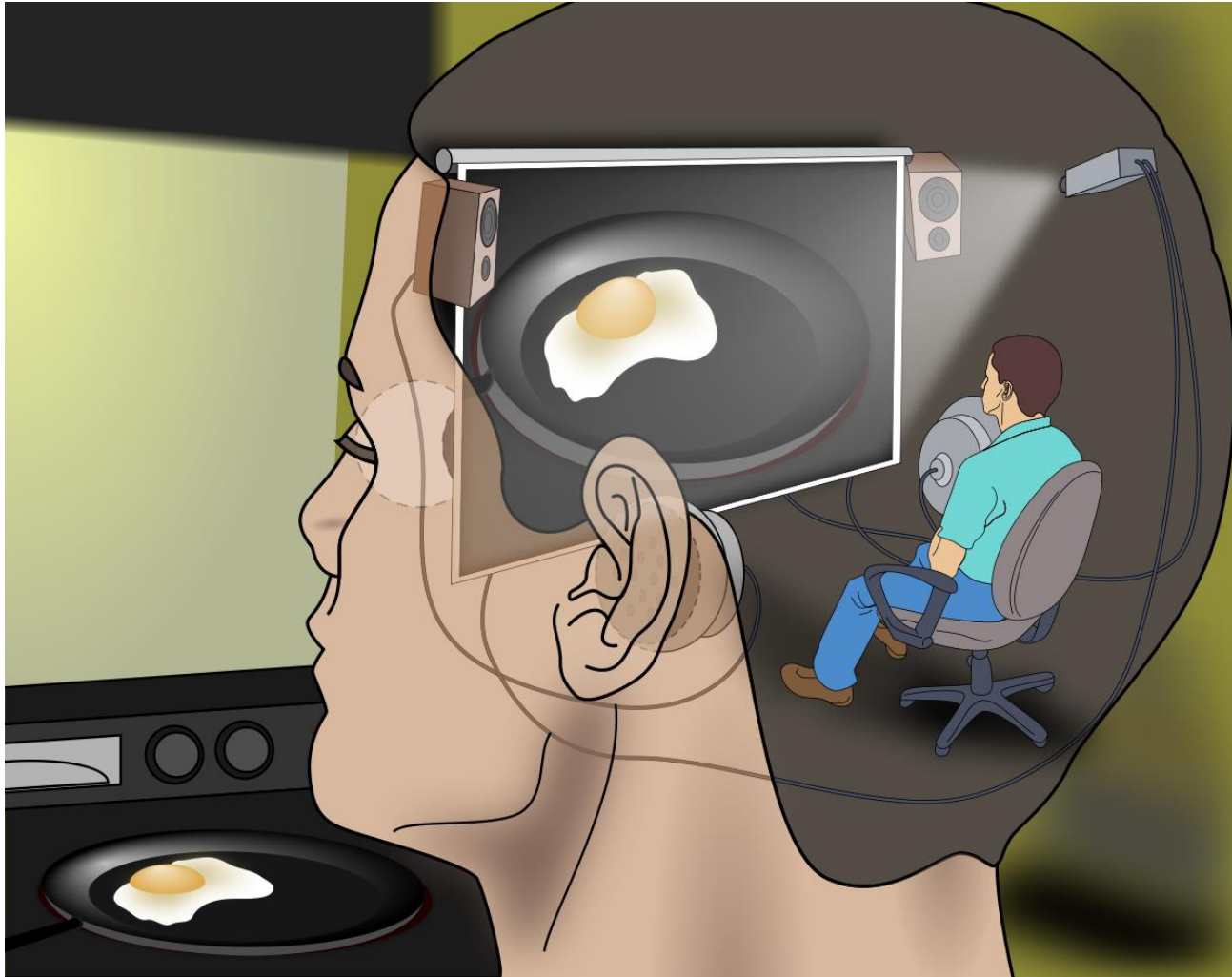
MATERIALISM

OUR THOUGHTS ARE PRODUCT OF
CHEMICAL REACTIONS

DUALISM

ANOTHER NAME OF MIND BODY PROBLEM

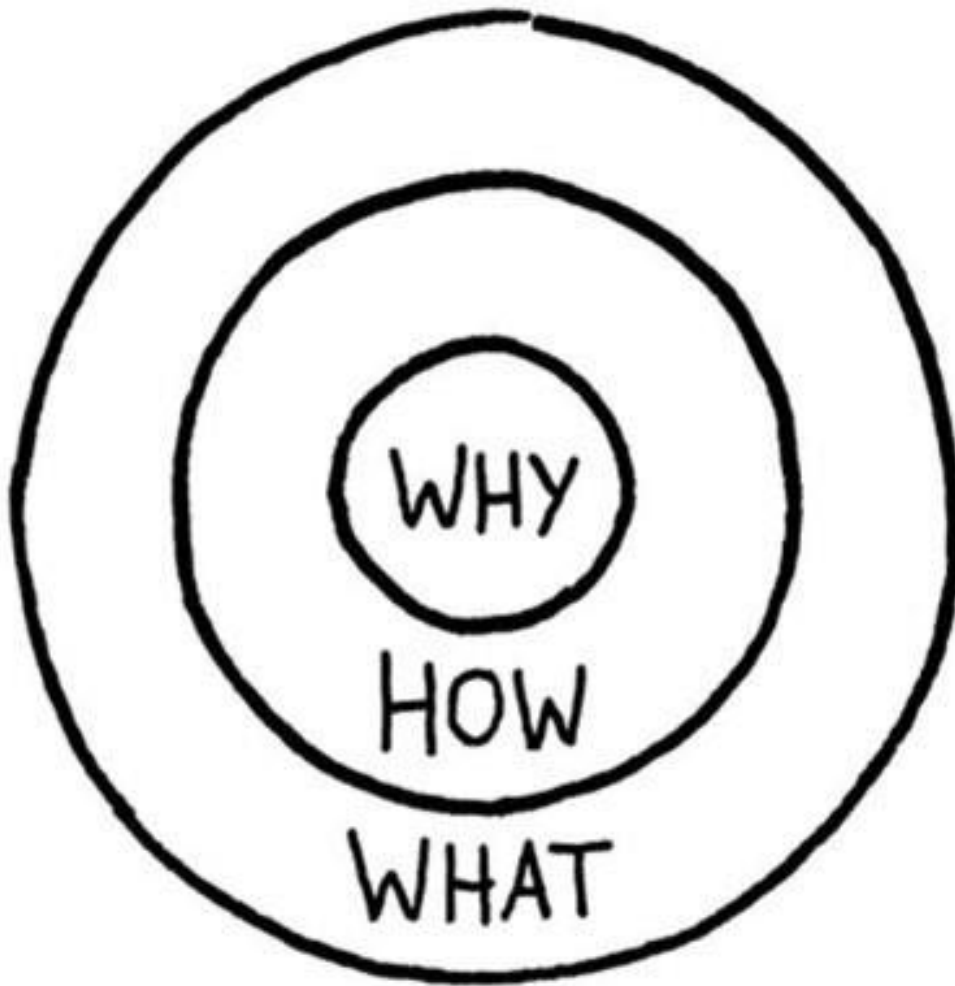
DUALISM



ASSIGNMENT 01

READ THE PAPER

GOLDEN CIRCLE



Why = The Purpose

What is your cause? What do you believe?

Apple: We believe in challenging the status quo and doing this differently

How = The Process

Specific actions taken to realize the Why.

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What = The Result

What do you do? The result of Why. Proof.

Apple: We make computers

HOW OF MACHINE LEARNING

SYMBOLIC LEARNING

SYMBOLIC LEARNING

In this approach the domain **knowledge** is represented through a **formal language**, such as **logic**, and retain this knowledge for future **inference**.

SYMBOLIC LEARNING



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HOW TO REPRESENT REAL WORLD OBJECT FOR EASILY PROCESSING?

Dr. Muhammad Awais Hassan
Department of Computer Science UET, Lahore

SYMBOLIC LEARNING

- For example, two instances of “ball” may be represented by:

$\text{size}(\text{obj1}, \text{small}) \wedge \text{color}(\text{obj1}, \text{red}) \wedge \text{shape}(\text{obj1}, \text{round})$
 $\text{size}(\text{obj2}, \text{large}) \wedge \text{color}(\text{obj2}, \text{red}) \wedge \text{shape}(\text{obj2}, \text{round})$

The general concept of “ball” could be defined by:

$\text{size}(X, Y) \wedge \text{color}(X, Z) \wedge \text{shape}(X, \text{round})$

SYMBOLIC ML ALGORITHMS

- Search Space Algorithms.
- Heuristic Search.
- Constraint Specification Problems.
- Decision Trees.
- Expert System

CONNECTIONIST LEARNING

CONNECTIONIST LEARNING

Connectionist AI hold that intelligence arises in systems of simple, interacting components (biological or artificial neurons) through a process of learning or adaptation by which the connections between components are adjusted.

CONNECTIONIST LEARNING



CONNECTIONIST LEARNING

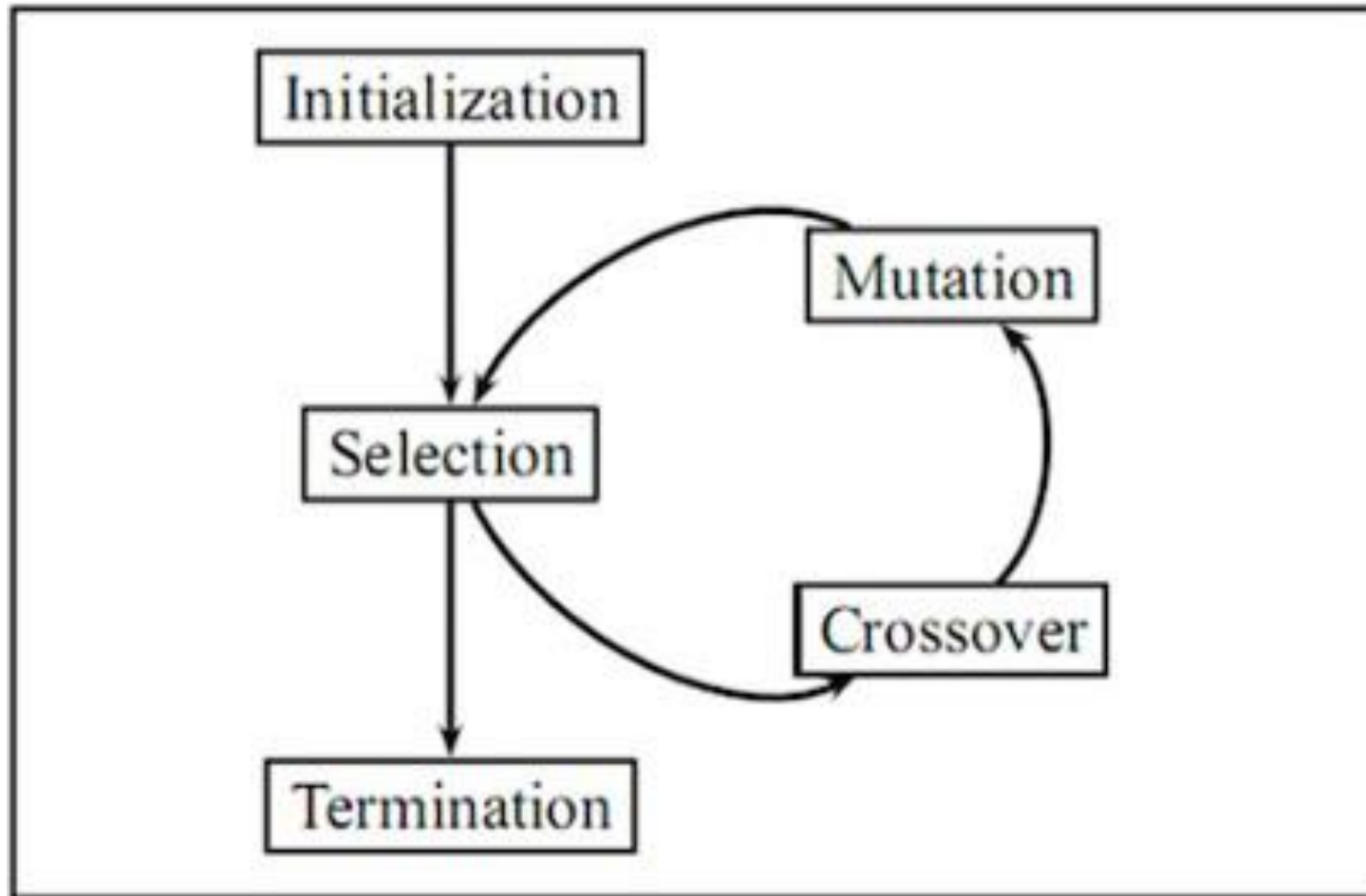
- ANN
- Deep Neural Networks
- SVM
- CNN

GENETIC OR EVOLUTIONARY LEARNING

EVOLUTIONARY LEARNING

- Like neural networks, genetic algorithms are based on a biological metaphor: They view learning as a competition among a population of evolving candidate problem solutions.

EVOLUTIONARY LEARNING



PROBABILISTIC LEARNING

PROBABILISTIC METHODS

- These learning models are inspired from the probabilistic models. Such as
 - Naïve Bayes
 - Bayesian Networks
 - Bayesian Belief Networks
 - Markov Decision Process



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QUESTIONS

WHAT OF MACHINE LEARNING

MACHINE LEARNING

- Ability to Learn without writing explicit code.

ROCK PAPER AND SCISSOR GAME

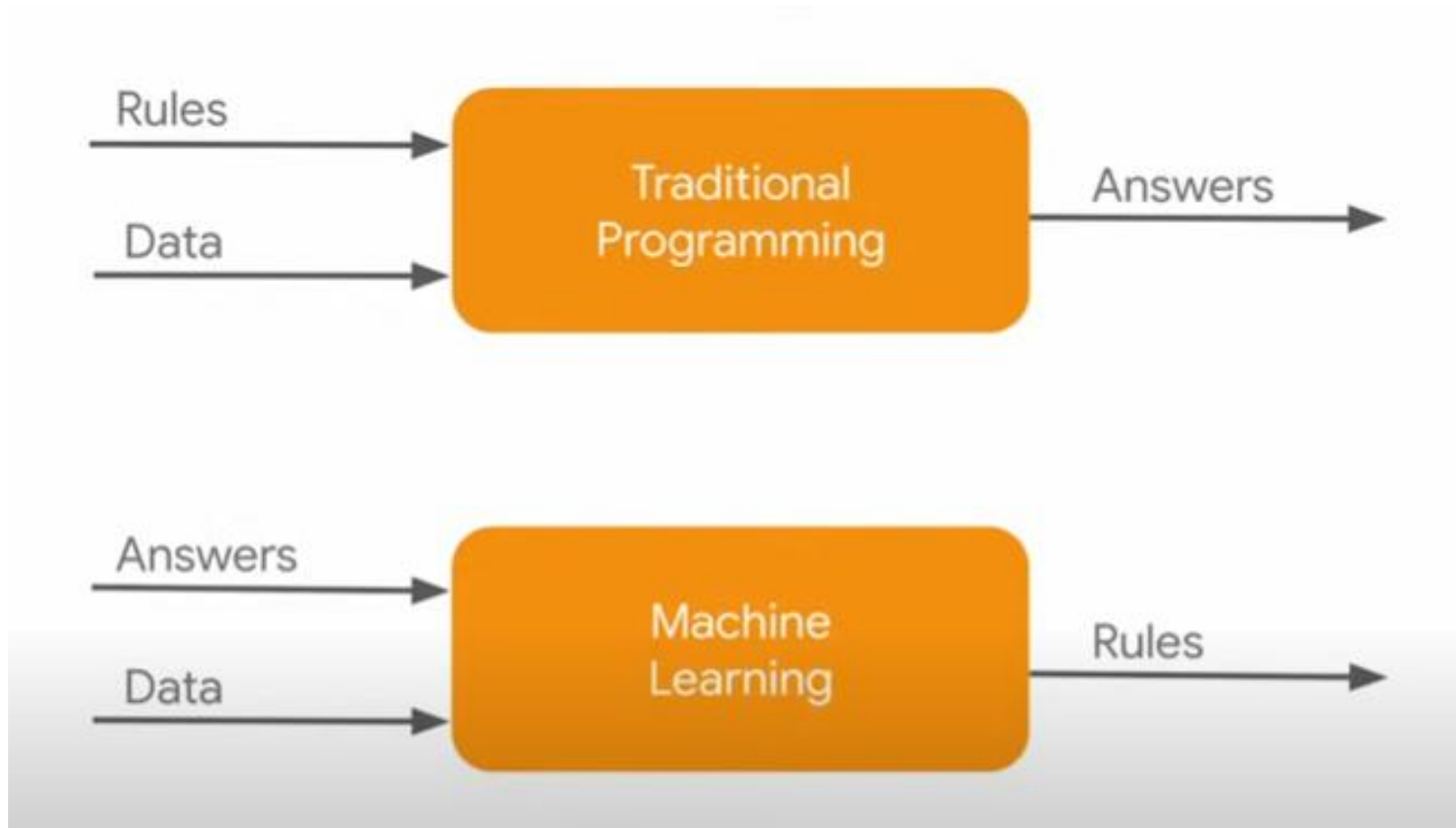
Imagine a Rock Paper Scissors Game...



WITHOUT MACHINE LEARNING



WITH MACHINE LEARNING



TYPE OF MACHINE LEARNING

- Supervised Learning.
- Unsupervised Learning.
- Reinforcement Learning.

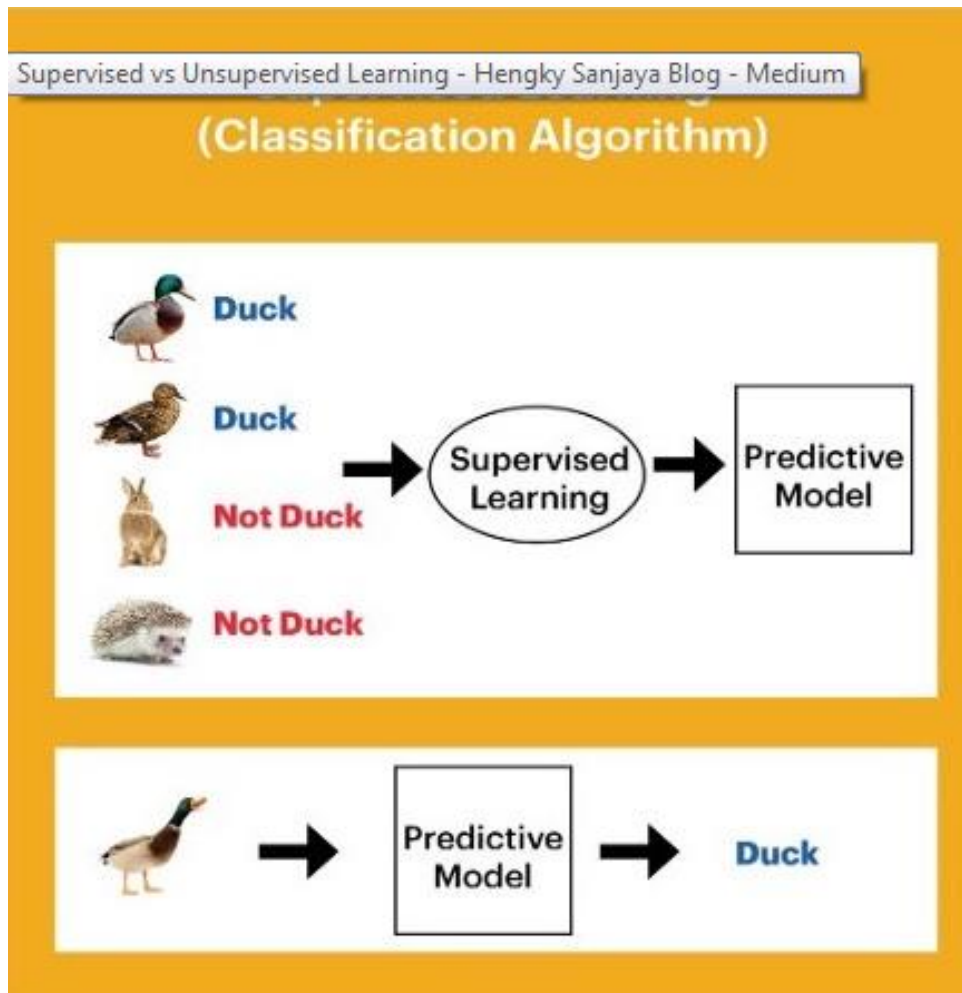
SUPERVISED LEARNING

Living area (feet ²)	Price (1000\$s)
2104	400
1600	330
2400	369
1416	232
3000	540
⋮	⋮

SUPERVISED LEARNING: REGRESSION

- When we try to predict a number from historical data this type of supervised learning problem is called Regression Problem

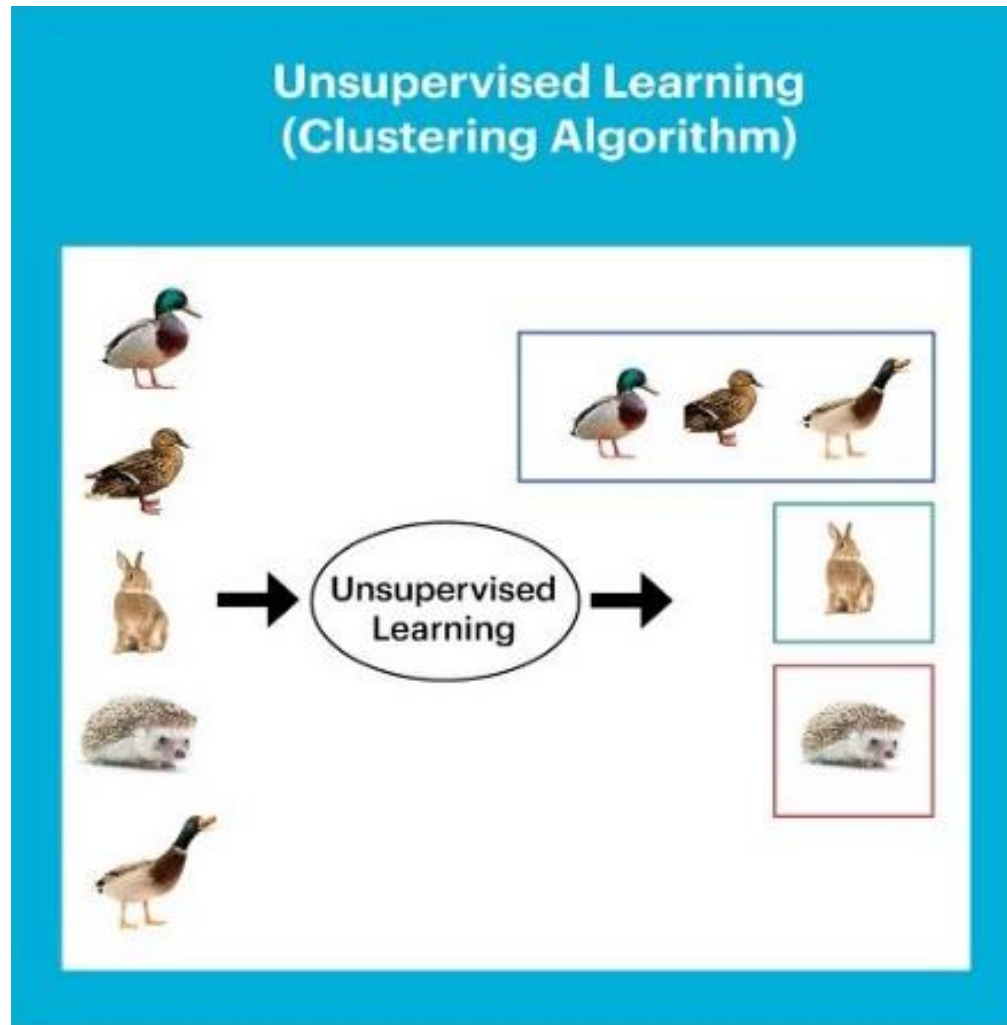
SUPERVISED LEARNING: CLASSIFICATION PROBLEM



UNSUPERVISED LEARNING:

When we try to separate related data without any prior information or in presence of any critic system, we can it unsupervised learning

UNSUPERVISED LEARNING



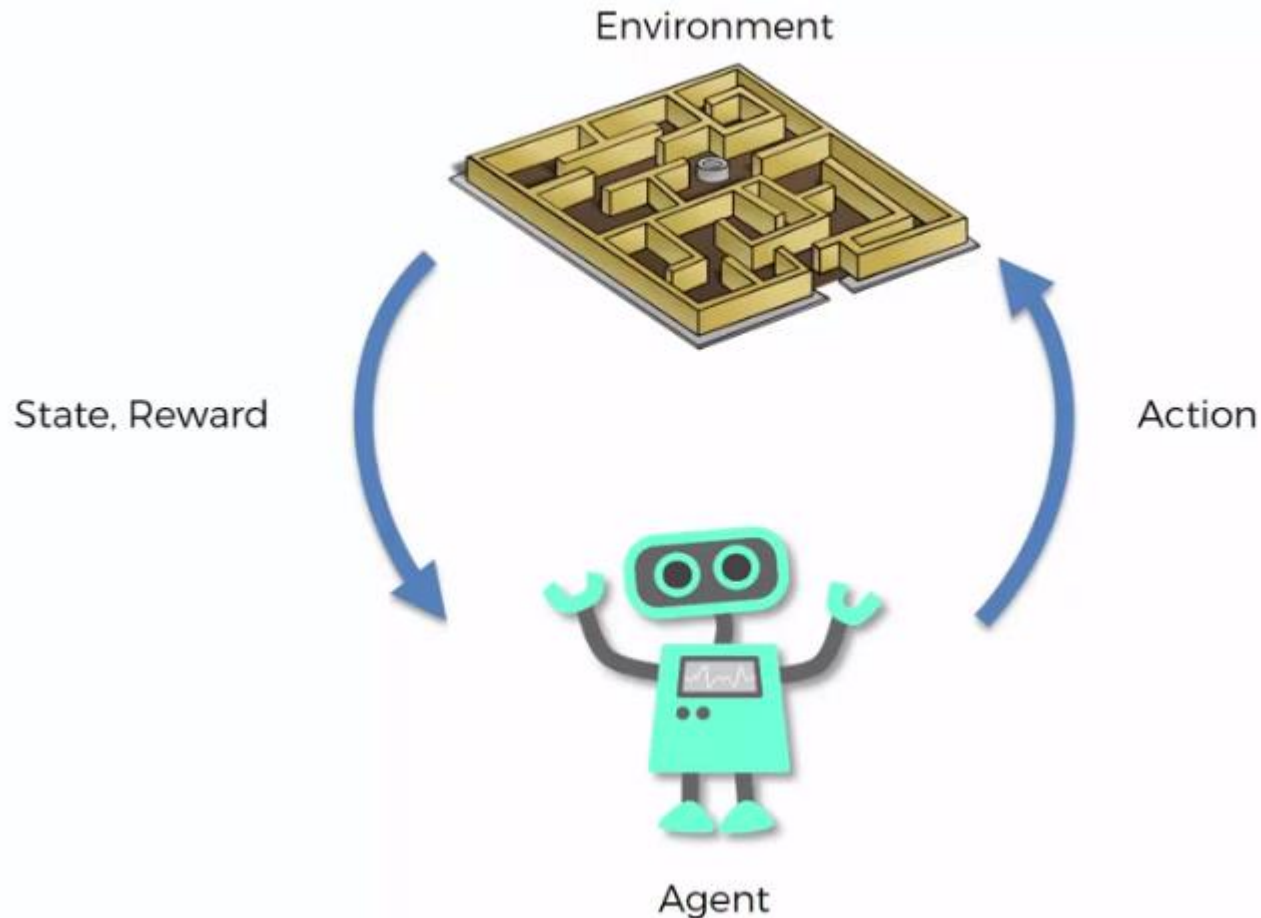
REINFORCEMENT LEARNING:

HOW DOGS ARE TRAINED



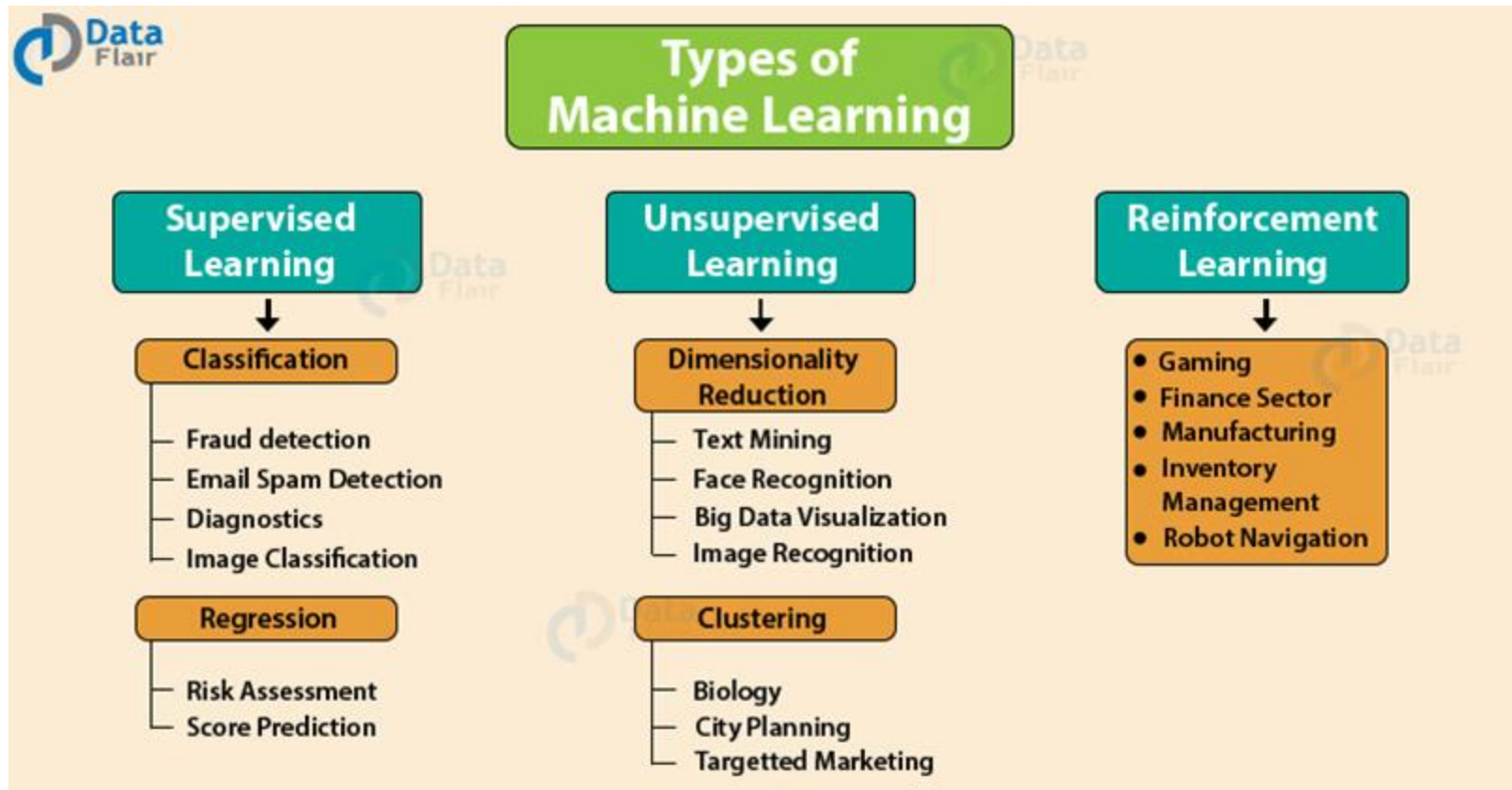
Credits: UDEMY A-Z Artificial Intelligence Course

REINFORCEMENT LEARNING



Credits: UDEMY A-Z Artificial Intelligence Course

REINFORCEMENT LEARNING



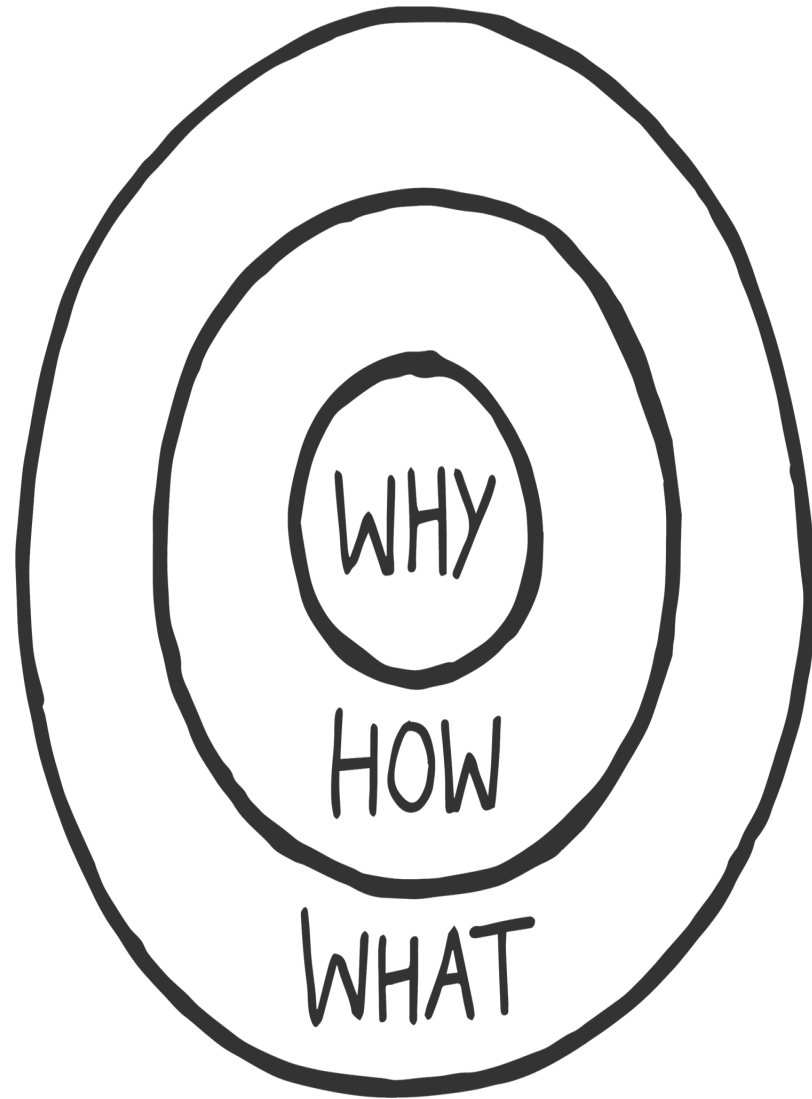
Credits: [Source Address](#)

GOLDEN CIRCLE MACHINE LEARNING



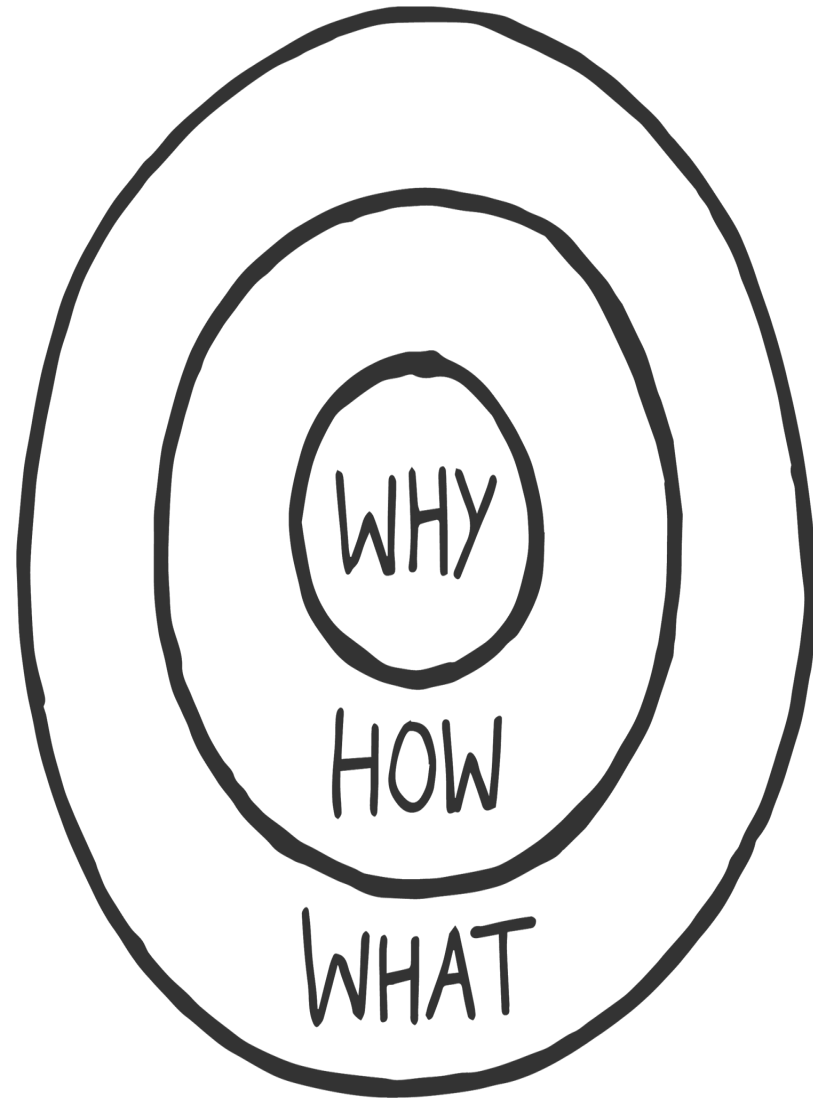
WHY

Making Machine to
Learn from Past
Experience



HOW

Symbolic
Connectionis
Evolutionary
Stochastic or
Probablistic



WHAT

Classification

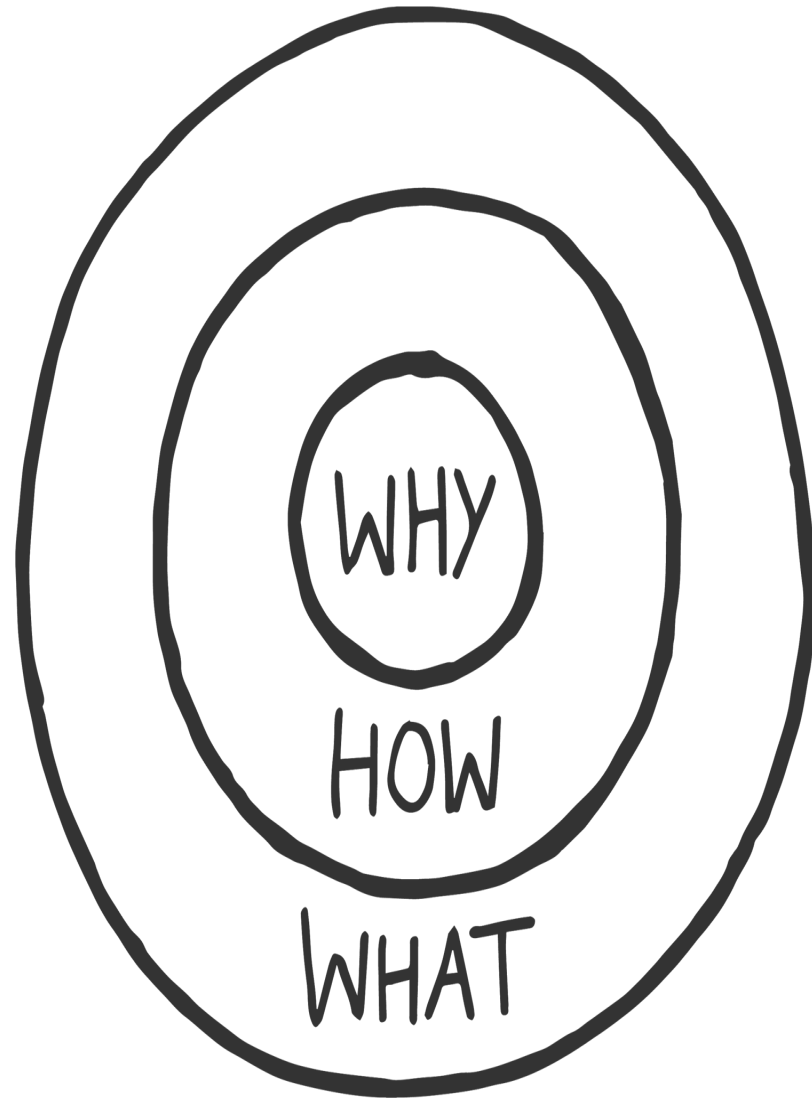
Regression

Clustering

Strategy to Achieving
Goals (RL)

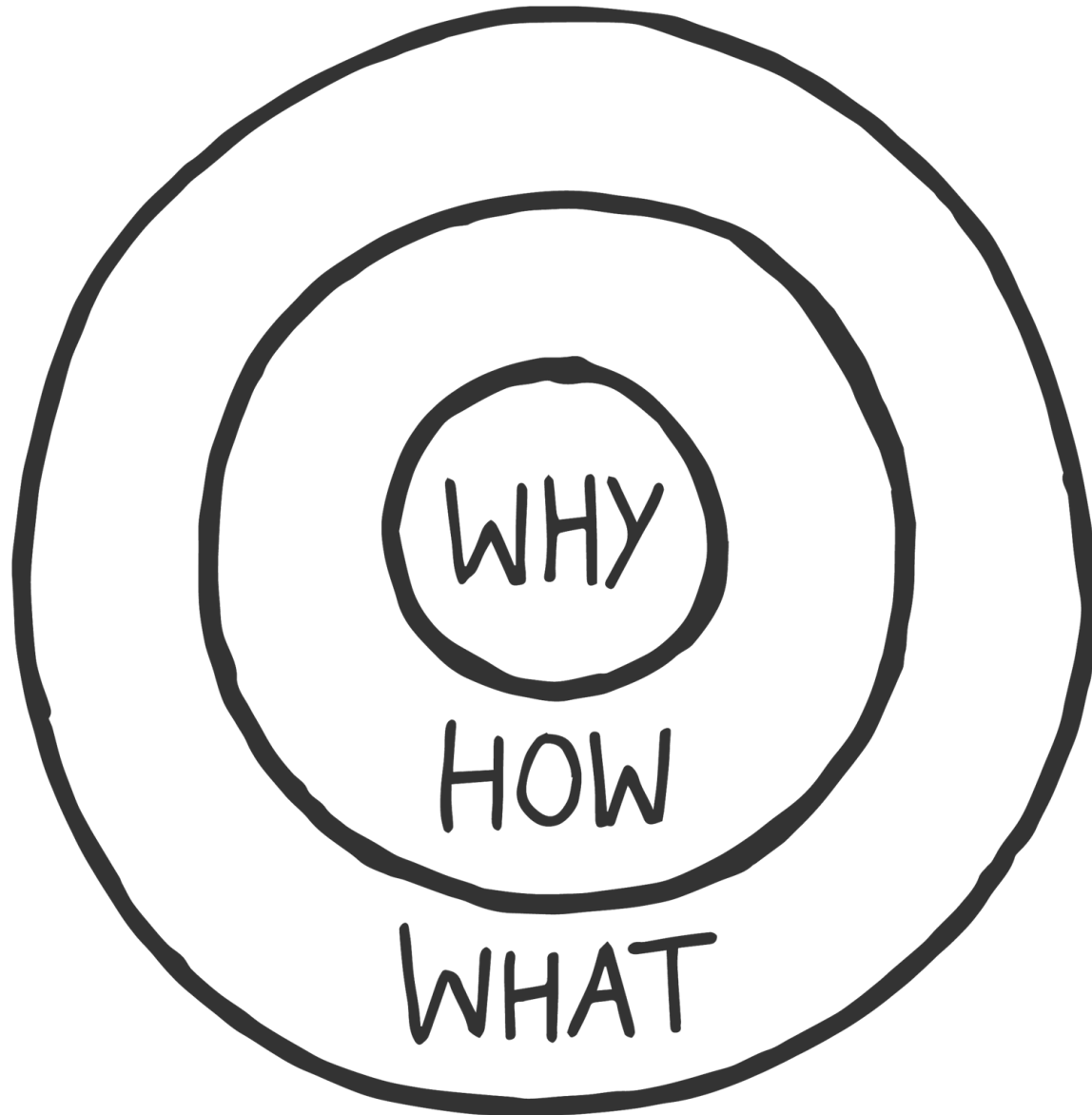
NLP

Vision



GOLDEN CIRCLE OF THE CLASS

GOLDEN CIRCLE OF THE CLASS



WHAT OF THE CLASS

WHY OF THE CLASS

1. WHY

- To train students those understand the science and math behind the Machine Learning Algorithms

YOUR WHY

- Why you are in this class ?
 - Grades ?
 - Requirement for Coursework ?
 - Using Keras/TensorFlow
- **Learn Science Behind ML**

YOUR WHY

- Why you are in this class ?
 - ~~Grades ?~~
 - ~~Requirement for Coursework ?~~
 - ~~Using Keras/TensorFlow~~
- Learn Science Behind ML

HOW OF THE CLASS

HOW OF ML CLASS

- In Class
 - Discuss a learning Algorithm
 - Do the relevant Mathematics in Class
 - An Example
- At Home
 - Code the Algorithm in Python (do not use APIs)
 - Code the Algorithm with API
 - Compare its performance.

WHAT OF THE CLASS

WEEK 03: SEARCH BASED LEARNING

- Real World Problem to Learning Problem Modeling
- Search Trees and Goal Finding.
- Heuristic Search.

WEEK 04-05: LINEAR REGRESSION

- What is Linear Regression
- Hypothesis-Model-Cost Function
- Finding Parameters.
- Problem Design for Gradient Descent.
- Math Behind Gradient Descent.
- Algorithm

WEEK 06:

LOGISTIC REGRESSION

- What is Logistic Regression.
- Formulating the Problem Mathematically
- Solving the Problem through Math
- Write the Algorithm
- Regularization

WEEK 07: CONNECTIONIST

- Association vs Connectionist
- Biological Background of Neuron
- McCullough and Pitts 's Model
- Hebbian learning
- Perceptron Learning
- Example
- Implementation of Perceptron (Python)

WEEK 08

- Limitation of Perceptron.
- Perceptron as Regressor
- Review Topics

WEEK 09

- Activation Function
- Universal Approximation
- Perceptron as Universal Approximation
- Geometric Proof of Perceptron as Universal Approximation.
- Why Deep Neural

WEEK 10

- Feed Forward and Backpropagation
- Calculating Feed Forward
- Conversion Optimization
- Forward Passing
- Backward Passing / BackPropogation

WEEK 11

- Neural network training algorithm
- Convergence
- Learning Rate Optimization
- Learning Rate Problems
- RPROP, QUICK PROP, MOMENTUM

WEEK 12: PROJECT EVALUATION

- **Note:** This is the only announcement for the project no other announcement shall be made
- You need to reproduce **experiments and results** of any published paper in impact factor journal.

WEEK 13: SUPPORT VECTOR MACHINE

- Philosophy behind support vector machines.
- Formulating problem Mathematically.
- Understand Large Margins.
- Math Behind Large Margins.
- Solving the Problem
- Algorithm

WEEK 13-14: UNSUPERVISED LEARNING

- K-Means Clustering
- Recommender System
- Dimensionality Reduction
- Principal Component Analysis
- Model the Problem Mathematically
- Algorithm

WEEK 15: REINFORCEMENT LEARNING

- What is Reinforcement Learning.
- Bellman Equations.
- Markov Decision Process.
- Model the Problem Mathematically
- Solved the Problem-Value Table
- Algorithm

WEEK 16

■ Project Evaluation II

Extra Marks if you generated better results and explain how did you do that.

EVALUATION AND ASSESSMENTS

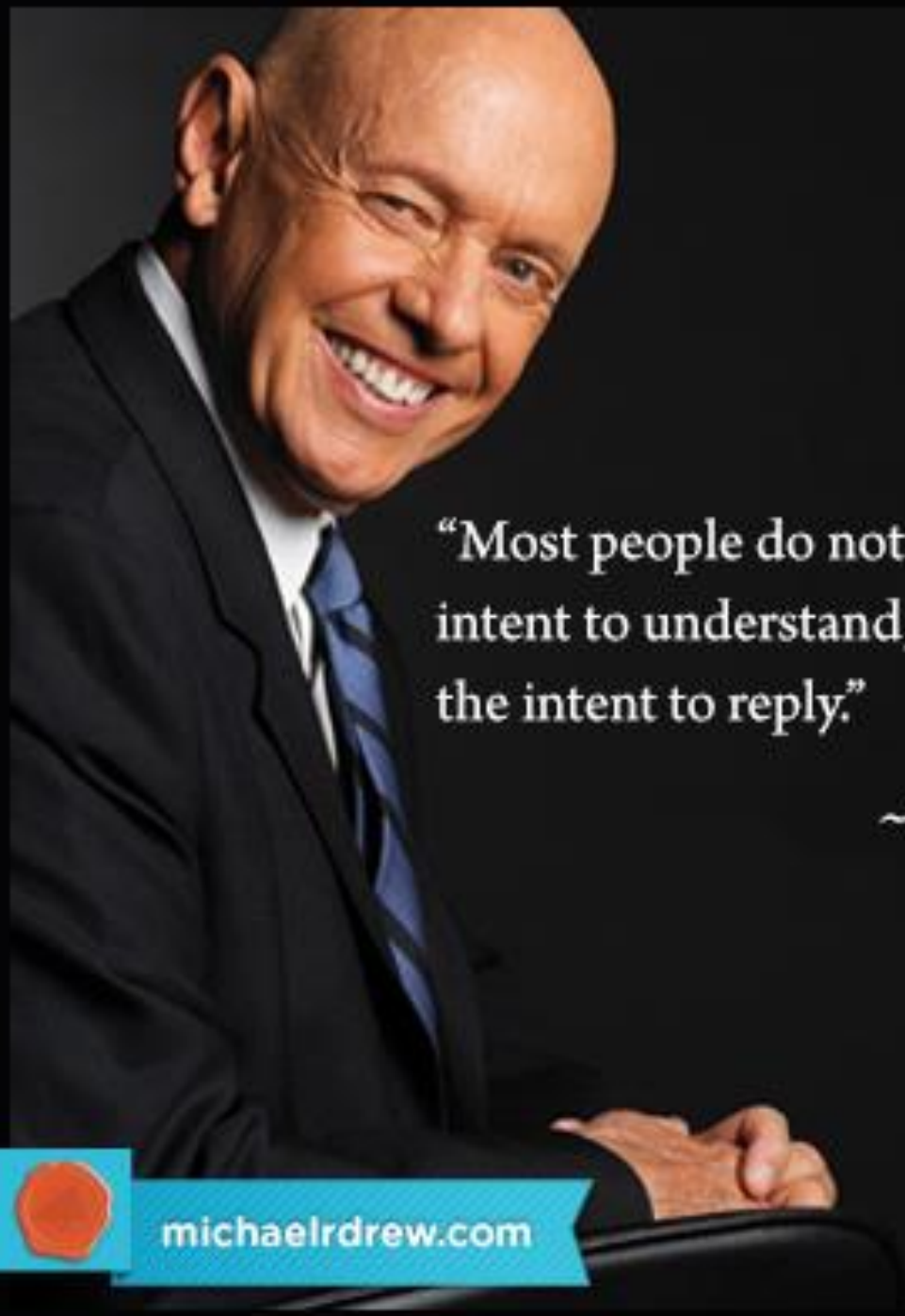
- Quiz 01: 10 Marks
- Mid Term: 20 Marks
- Project 01: 10 Marks
- Project 02: 10 Marks
- Final Term: 30 Marks
- Assignments: 20 Marks
(Programming)

ASSIGNMENT 02

Review Python

Understand PACMAN Project

Move the PACMNA around See the Detail in the Assignment folder.



“Most people do not listen with the intent to understand; they listen with the intent to reply.”

~Stephen R. Covey
(1932-2012)



michaeldrew.com

- If two person arguing that we should stop them and ask them to repeat. Mostly people do not understand what other says.
- Suno Mulla Ayeet number 10

اور کہیں گے اگر ہم ہوتے سنتے یا سمجھتے تو نہ
ہوتے دوزخیوں میں۔

وَقَالُوا لَوْ كُنَّا نَسْمَعُ أَوْ نَعْقِلُ مَا كُنَّا
فِي أَصْحَابِ السَّعِيرِ ﴿١٠﴾

INTRODUCTION AND RULES

THE NEXT 20 SLIDES ARE BARROWED FROM THE TIME LANDERS.

INTRODUCTION

- Name:
- Roll Number
- School/College/University
- Hobbies:
- Your expectations out of this course

GUIDELINES FOR PARTICIPANTS

- Timings
- Mobile/cell phones
- Questions & Answers
 - Answer immediately
 - Please wait





GUIDELINES FOR PARTICIPANTS

- Timings
- Mobile/cell phones
- Questions & Answers
 - Answer immediately
 - Please wait
 - Meet with trainer (one on one)



GUIDELINES FOR PARTICIPANTS

- Timings
- Mobile/cell phones
- Questions & Answers
 - Answer immediately
 - Please wait
 - Meet with trainer (one on one)
 - Hold on



GUIDELINES FOR PARTICIPANTS

- Timings /attendance
- Mobile/cell phones
- Questions & Answers
 - Answer immediately
 - Please wait
 - Meet with trainer (one on one)
 - Hold on
 - Don't know the answer