

COMPUTER SCIENCE

Prepared by:
Fritz Eugene Bansag



COMPUTER SCIENCE

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

This lesson is designed for 1 Period

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

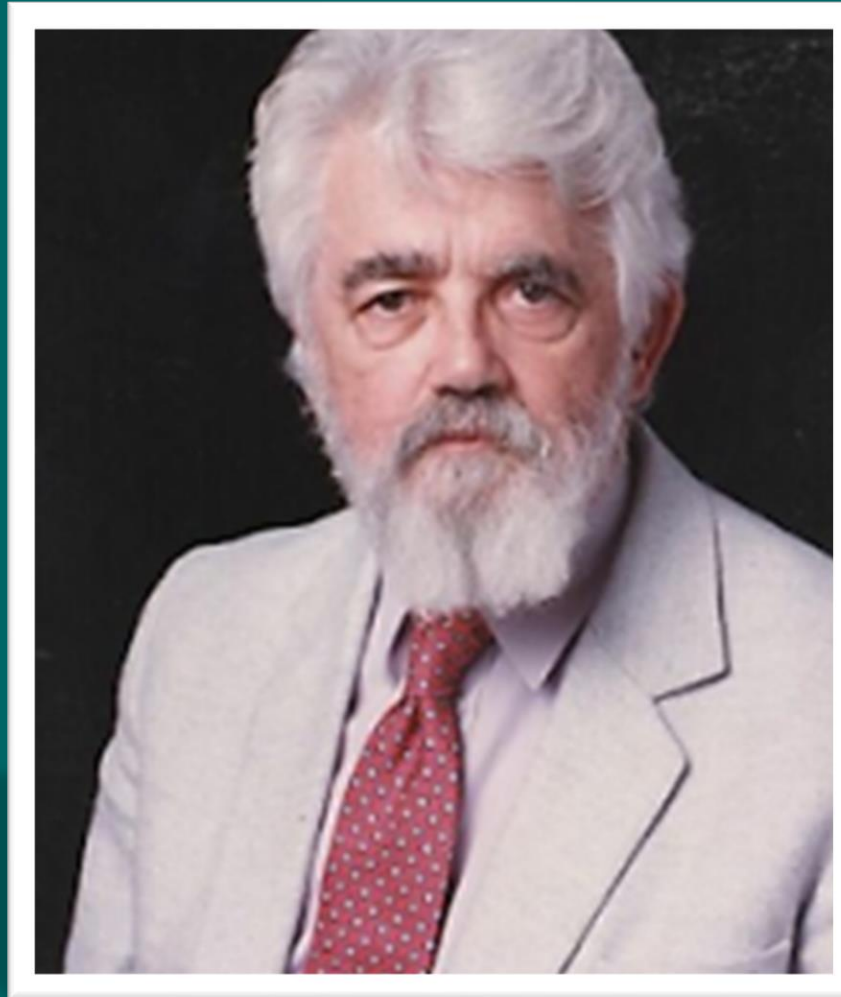
ACTIVITIES

PLENARY

EXTENSION

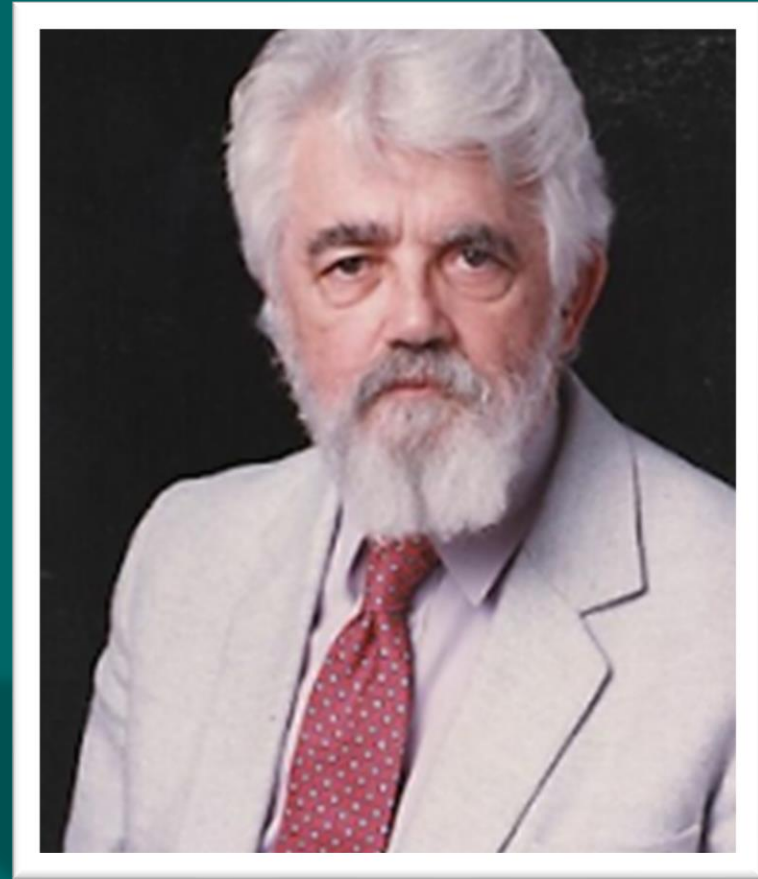
3

WHO AM I

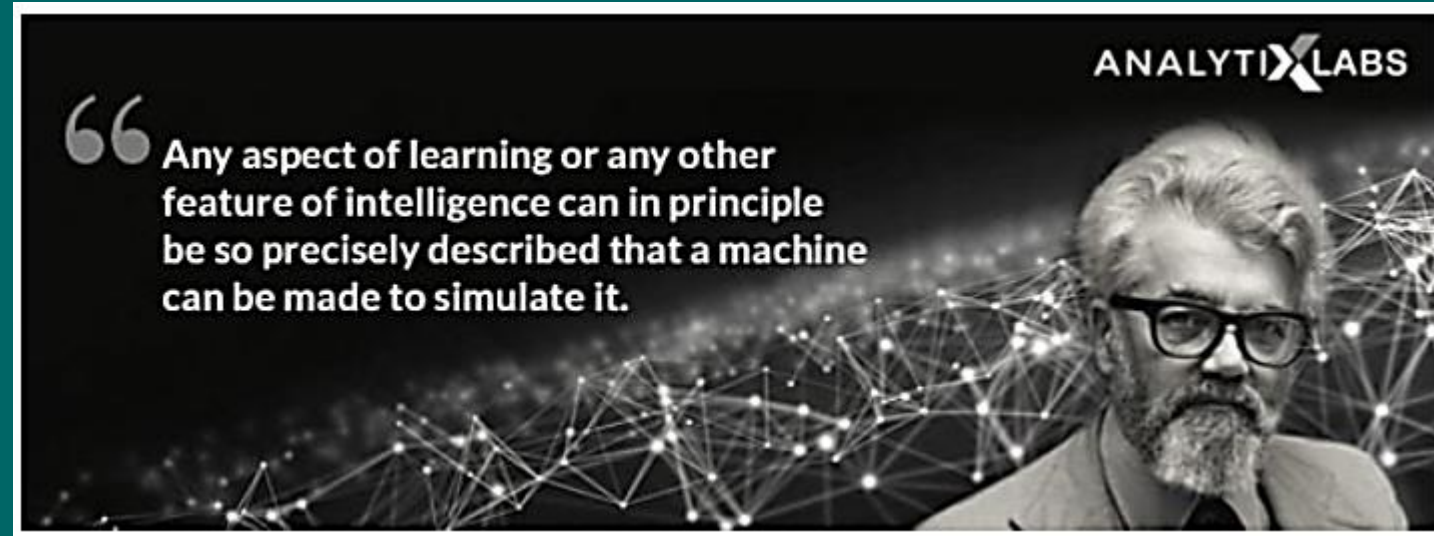


WHO AM I

I am the
father
of
Artificial Intelligence?



WHO AM I



JOHN MACARTHY

He is a Computer Scientist who pioneered and coined the term artificial intelligence.



LESSON OBJECTIVES

- Describe what artificial intelligence is.
- Identify the characteristics of artificial intelligence.
- Create Expert Systems basic operational setup

YOUR SUCCESS CRITERIA

- You **could** create Expert Systems basic operation setup
- You **should** be able to identify the characteristics of artificial intelligence.
- You **must** be able to describe what artificial intelligence is.

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

KNOWING WHAT YOU KNOW

Go to :

<https://joinmyquiz.com>

Join Code: 542100

Use your realname and grade level

Example: Huong 10G3

You are to answer based on your prior knowledge (if any)

LINKING LESSON LEARNT

- **Previously**
You have learnt on the Automated & Emerging Technologies (Automated Systems & Robotics)
- **Today**
You will be building up your progress on Emerging Technologies on Artificial Intelligence & Expert Systems
- **What's next after this lesson.**
You will build more on Emerging Technologies with Machine Learning & completion of Robotics & AI inference badges at idea.org.uk

DESCRIBING TERMS

Narrow AI

Artificial Intelligence

Strong AI

Machine Learning

cognitive

General AI

Expert Systems

- TRIVIA
- OBJECTIVES
- STARTER
- LINKING
- PRESENTATION**
- ACTIVITIES
- PLENARY
- EXTENSION

- _____ a term that describes the function of the human brain.
- _____ occurs when a machine has superior performance to a human in doing one specific task.
- _____ occurs when a machine has superior performance to a human when doing a specific task.
- _____ occurs when a machine is similar (superior) in its performance to a human doing a specific task.

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe what artificial intelligence is

DESCRIBING TERMS

Narrow AI

Artificial Intelligence

Strong AI

Machine Learning

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Expert Systems

cognitive

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DESCRIBING TERMS

Artificial Intelligence

Strong AI

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Expert Systems

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DESCRIBING TERMS

12

Artificial Intelligence

Machine Learning

General AI

Expert Systems

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ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe what artificial intelligence is

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STARTER

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PRESENTATION

ACTIVITIES

PLENARY

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Machine Learning

Expert Systems

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ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe what artificial intelligence is

ARTIFICIAL INTELLIGENCE

14

What Artificial Intelligence is

- *Is the ability of a computer or computer-controlled robot to perform tasks that are commonly associated with the intellectual processes' characteristic of humans, such as ability to reason. – (Britannica.com)*
- *Is technology that enables computers and machines to simulate human intelligence and problem-solving capabilities. – (ibm.com)*
- *It is a branch of Computer Science dealing with the simulation of intelligent human behaviour by a computer.*

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe what artificial intelligence is

ARTIFICIAL INTELLIGENCE CATEGORIES

Narrow AI

occurs when a machine has superior performance to a human in doing one specific task.

Strong AI

occurs when a machine has superior performance to a human when doing a specific task.

General AI

occurs when a machine is similar (not superior) in its performance to a human doing a specific task.

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STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe what artificial intelligence is

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

16

A

It has ability to draw reasoned conclusions based on given data/situation using deductive reasoning .

B

A set of logical choices given as binary data

C

It is a collection of rules and data

D

Is a database of human behaviour

E

It can simulate and predict outcomes with a set of minimal data and extensive human intervention.

F

It has learning capability by carrying out a sequence of steps, improve methodologies, and adapt to its surrounding

G

Is a collection of electronic patterns

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

17

A

It has ability to draw reasoned conclusions based on given data/situation using deductive reasoning .

C

It is a collection of rules and data

F

It has learning capability by carrying out a sequence of steps, improve methodologies, and adapt to its surrounding

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OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

18

C

It is a collection of rules and data

ACTIVITY FOR ALL: HA / MA

Objective: Identify the characteristics of artificial intelligence

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

19

C

It is a collection of rules and data

A

It has ability to draw reasoned conclusions based on given data/situation using deductive reasoning .

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

20

C

It is a collection of rules and data

A

It has ability to draw reasoned conclusions based on given data/situation using deductive reasoning .

F

It has learning capability by carrying out a sequence of steps, improve methodologies, and adapt to its surrounding

CHARACTERISTICS OF AI

Can you identify the characteristics of Artificial Intelligence ?

21

C

It is a collection of rules and data

A

*It has ability to draw reasoned conclusions based on given data/situation using **deductive reasoning**.*

F

It has learning capability by carrying out a sequence of steps, improve methodologies, and adapt to its surrounding

DEDUCTIVE AND INDUCTIVE REASONING

- *Is the ability to draw reasoned conclusions based on given data/situations. This type of reasoning uses patterns to arrive at a conclusions.*

- *Is where a number of correct facts are built up to form a set of rules which can then be applied to other problems. This type of reasoning uses acts, rules, definitions, or attributes to arrive at a conclusion.*

DEDUCTIVE AND INDUCTIVE REASONING

Which among the definition is deductive or inductive reasoning?

- *Is the ability to draw reasoned conclusions based on given data/situations. This type of reasoning uses patterns to arrive at a conclusions.*

- *Is where a number of correct facts are built up to form a set of rules which can then be applied to other problems. This type of reasoning uses acts, rules, definitions, or properties to arrive at a conclusion.*

DEDUCTIVE AND INDUCTIVE REASONING

INDUCTIVE REASONING

Is the ability to draw reasoned conclusions based on given data/situations. This type of reasoning uses patterns to arrive at a conclusions.

DEDUCTIVE REASONING

Is where a number of correct facts are built up to form a set of rules which can then be applied to other problems. This type of reasoning uses acts, rules, definitions, or properties to arrive at a conclusion.

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ACTIVITY FOR ALL: HA / MA / LA

EXAMPLES OF ARTIFICIAL INTELLIGENCE

- *News generation based live news feeds.*

**TRANSFORMING
LIVE STREAMING WITH
ARTIFICIAL
INTELLIGENCE**



EXAMPLES OF ARTIFICIAL INTELLIGENCE

- *News generation based live news feeds.*
- *Smart home and devices assistants (such as Amazon Alexa, Google Now, Apple Siri, and Microsoft Cortana).*



Fire off

EXAMPLES OF ARTIFICIAL INTELLIGENCE

- *News generation based live news feeds.*
- *Smart home devices (such as Amazon Alexa, Google Now, Apple Siri, and Microsoft Cortana).*
- **Autonomous Cars**



Stopping For Pedestrians

EXAMPLES OF ARTIFICIAL INTELLIGENCE

- *News generation based live news feeds.*
- *Smart home devices (such as Amazon Alexa, Google Now, Apple Siri, and Microsoft Cortana).*
- *Autonomous Cars*
- *Facial recognition*

NAMEID= 705 FPS 11:53



TYPES OF ARTIFICIAL INTELLIGENCE

Connect the name to the statement/definition.

33

ROBOTICS

MACHINE LEARNING

DEEP MIND AI

EXPERT SYSTEMS

Is an artificial intelligence that is developed human knowledge and experience. They are usually used for answering questions using knowledge and inference.

Is a subset of artificial intelligence in which machines are trained to learn from past experiences or with sample data, to allow it to predict about new unseen data without the need to specifically program it for new data.

TYPES OF ARTIFICIAL INTELLIGENCE

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Is an artificial intelligence that is developed human knowledge and experience. They are usually used for answering questions using knowledge and inference.

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Is a subset of artificial intelligence in which machines are trained to learn from past experiences or with sample data, to allow it to predict about new unseen data without the need to specifically program it for new data.

SPECIFIC APPLICATIONS

35

EXPERT SYSTEMS

- *Diagnosis of patient illness*
- *Car or machine fault diagnostics*
- *Tax and Financial calculations*
- *Logistics (efficient routing of parcel deliveries)*
- *Oil and mineral prospecting*

MACHINE LEARNING

- *Computation Finance (Credit scoring, algorithmic trading)*
- *Computer Vision (Facial Recognition, Motion Tracking, Object detection.*
- *Natural Language processing (Voice recognition)*

PRESENTATION

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PLENARY

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ACTIVITY FOR ALL: HA / MA / LA

Objective: Identify the characteristics of artificial intelligence

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OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION



EXPERT SYSTEMS

SETTING UP ACTIVITY

ACTIVITY FOR ALL: HA / MA / LA

Objective: Create Expert Systems basic operational setup

EXPERT SYSTEMS ELEMENTS

1. _____ : Which allows users to interact with the system
2. _____ : Acts as a search engine, it will allow query the "Knowledge base" to match the user's query.
3. _____ : Information developed by experts based on a collection of facts and rules.
4. _____ : Same to "Knowledge base. Used to make deductions or choices.
5. _____ : Supply information that clarifies the structure for the user.

ROBOT

USER INTERFACE

INFERENCE ENGINE

EXPLANATION SYSTEM

KNOWLEDGE BASE

RULES BASE

ACTIVITY FOR ALL: HA / MA / LA

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LINKING

PRESENTATION

ACTIVITIES

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ROBOT

MACHINE LEARNING

ARTIFICIAL INTELLIGENCE

EXPLANATION SYSTEM

KNOWLEDGE BASE

RULES BASE

Objective: Create Expert Systems basic operational setup

EXPERT SYSTEMS ELEMENTS

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- STARTER
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ACTIVITY FOR ALL: HA / MA / LA

ROBOT	MACHINE LEARNING	ARTIFICIAL INTELLIGENCE
EXPLANATION SYSTEM	ROBOTICS	RULES BASE

Objective: Create Expert Systems basic operational setup

EXPERT SYSTEMS ELEMENTS

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ACTIVITY FOR ALL: HA / MA / LA

ROBOT	MACHINE LEARNING	ARTIFICIAL INTELLIGENCE
EXPLANATION SYSTEM	ROBOTICS	FACIAL RECOGNITION

Objective: Create Expert Systems basic operational setup

EXPERT SYSTEMS ELEMENTS

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LINKING

PRESENTATION

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ACTIVITY FOR ALL: HA / MA / LA

ROBOT

MACHINE LEARNING

ARTIFICIAL INTELLIGENCE

COMPUTER SYSTEM

ROBOTICS

FACIAL RECOGNITION

Objective: Create Expert Systems basic operational setup

EXPERT SYSTEMS DIAGRAM

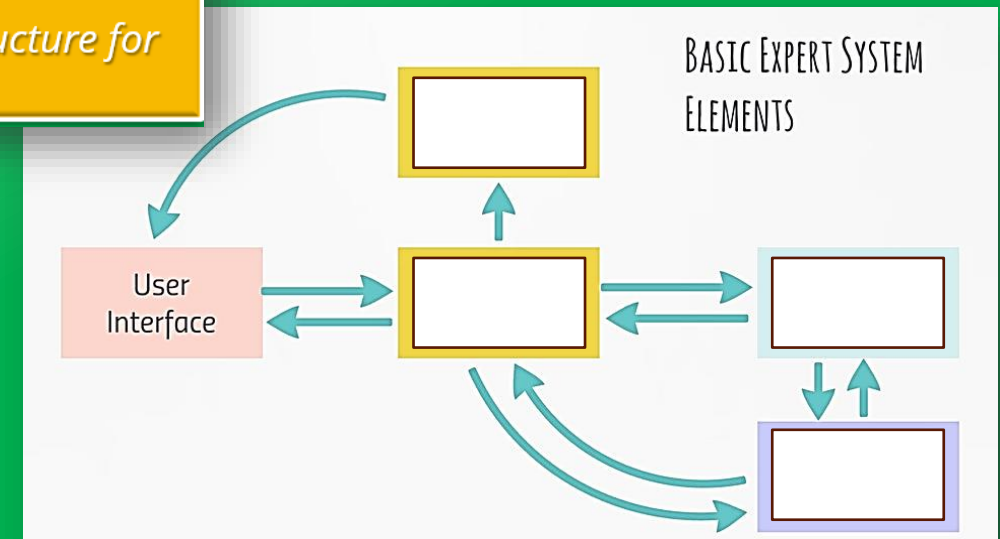
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Thinking Deep

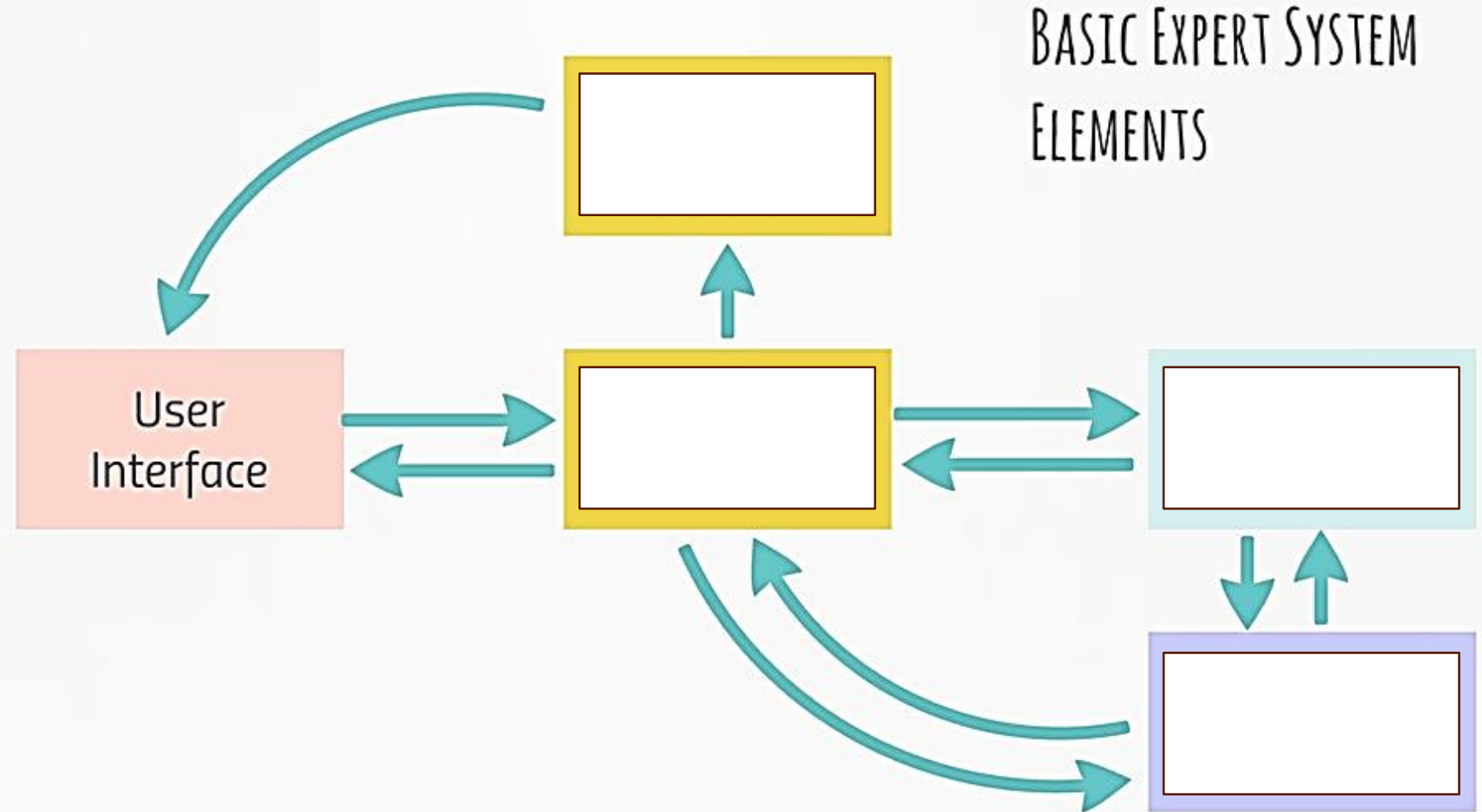
| Group of 3 |
All correct
wins a prize

Based on the description of elements and the diagram shown, create the Basic Expert System setup in order.

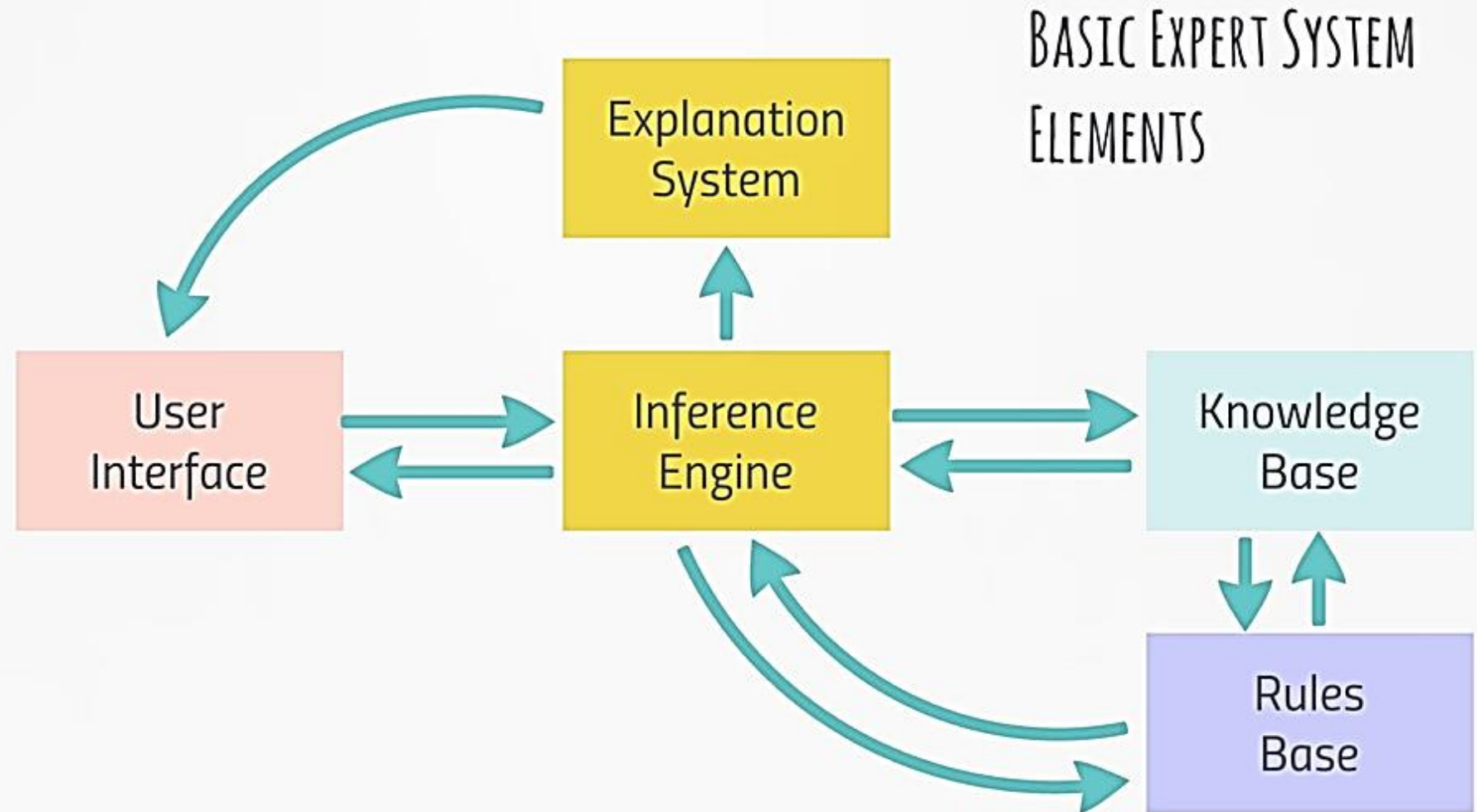
ACTIVITY FOR ALL: HA / MA



EXPERT SYSTEMS DIAGRAM



EXPERT SYSTEMS DIAGRAM



SETTING UP AN EXPERT SYSTEM



1. *Interview an Expert*
2. *Collect Data*
3. *Create KNOWLEDGE Base (to store data)*
4. *Create RULES Base with INFERENCE ENGINE*
5. *Create an EXPLANATION System*
6. *Create USER interface*
7. *Test Expert System against known condition*
8. *Ask expert opinion before releasing the system*

ACTIVITY FOR ALL: HA / MA / LA

Objective: Create Expert Systems operational setup

EXPERT SYSTEM SIMULATION EXAMPLE

What could be the object conclusion based on the questions ?

Object	CAT	WHALE	DUCK
Attribute_1	Mammal	Mammal	Bird
Attribute_2	Can be a pet	Not a pet	Not a pet
Attribute_3	Lives on Land	Lives in water	Lives in water
Attribute_4	Make meow sounds	Makes a sonic sound	Makes a quack sound
Attribute_5	Body covered in fur	Body covered in skin	Body covered in feathers
Attribute_6	Walks; has four legs	Swims; has no legs	Swims; has two legs

An expert system could ask the user responses based on a series of questions.

- ❑ *Is it a mammal ? **YES***
- ❑ *Can it be a pet? **NO***
- ❑ *Does it make sonic sounds? **YES***
- ❑ *Is its body covered in skin? **YES***
- ❑ *Does it have any legs? **NO***

EXPERT SYSTEM SIMULATION EXAMPLE

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ACTIVITIES

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ACTIVITY FOR ALL: HA / MA

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

19

KNOWING WHAT YOU LEARNED

Go to :

<https://joinmyquiz.com>

Join code: 770036

Use your realname and grade level

Example: Huong 10G5

Follow instructions as this is a combined class grade levels.

EXTENSION ACTIVITY

- TRIVIA
- OBJECTIVES
- STARTER
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- PRESENTATION
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Question 6

A company is involved in robotics

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE 0478/12

Paper 1 Computer Systems February/March 2023

1 hour 45 minutes

(d) The robot needs to find its way through different puzzles. Each puzzle has a series of paths that the robot needs to follow to find its way to the end of the puzzle. The puzzle contains dead ends and obstacles, so the robot needs to decide which way to go.

The robot's program will use artificial intelligence (AI).

(i) Describe the characteristics of AI.

.....

.....

.....

.....

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.....

..... [3]

(ii) Explain how the program will use AI.

.....

.....

.....

.....

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.....

.....

.....

.....

..... [4]

ACTIVITY FOR FAST LEARNERS : HA

This is the extended challenge activity for HA/MA

EXTENSION ACTIVITY

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

Question 6 Markscheme

6(d)(i)	<p>Any three from: e.g.</p> <ul style="list-style-type: none"> • Collects data • Stores rules for using the data • The ability to reason • The ability to learn // uses machine learning • ... by adapting what it does • ... for example, from mistakes to not make them again // result from previous decisions impacts future • ... by changing its own rules • ...by changing its own data • ...by being trained • Makes one or more predictions (to make a decision) • Find/analyse patterns 	3
6(d)(ii)	<p>Four from: e.g.</p> <ul style="list-style-type: none"> • Use machine learning algorithms • Collects data about where it has been • Collect data about obstacles/problems • Store successful actions • Stores unsuccessful actions • Identify/store patterns • ... to make sure it does not repeat the same incorrect route • ... so, it knows how to react to obstacles next time • ...so, it knows what is most likely to work next time 	4

ACTIVITY FOR FAST LEARNERS : HA

This is the extended challenge activity for HA/MA

THANK YOU

- fritz.bansag@vas.edu.vn
- mail@febstar.com

CREDIT

- Credit to text, graphics, images, videos, illustrations, etc. respective owners in this presentation. For educational purposes only. Thank you.



COMPUTER SCIENCE

MACHINE LEARNING

This lesson is designed for 1 Period

LESSON OBJECTIVES

- Describe what machine learning is.
- Identify the types and characteristics of machine learning.
- Complete IDEA Badges: Chatbots, Robotics, and AI Inference

YOUR SUCCESS CRITERIA

- You **could** be able to complete IDEA Badges
- You **should** be able to identify the types and characteristics of machine learning
- You **must** be able to describe what machine learning is.

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

KNOWING YOUR PRIOR LEARNING

55

Go to :

<https://joinmyquiz.com>

Join Code: 619704

Use your realname and grade level

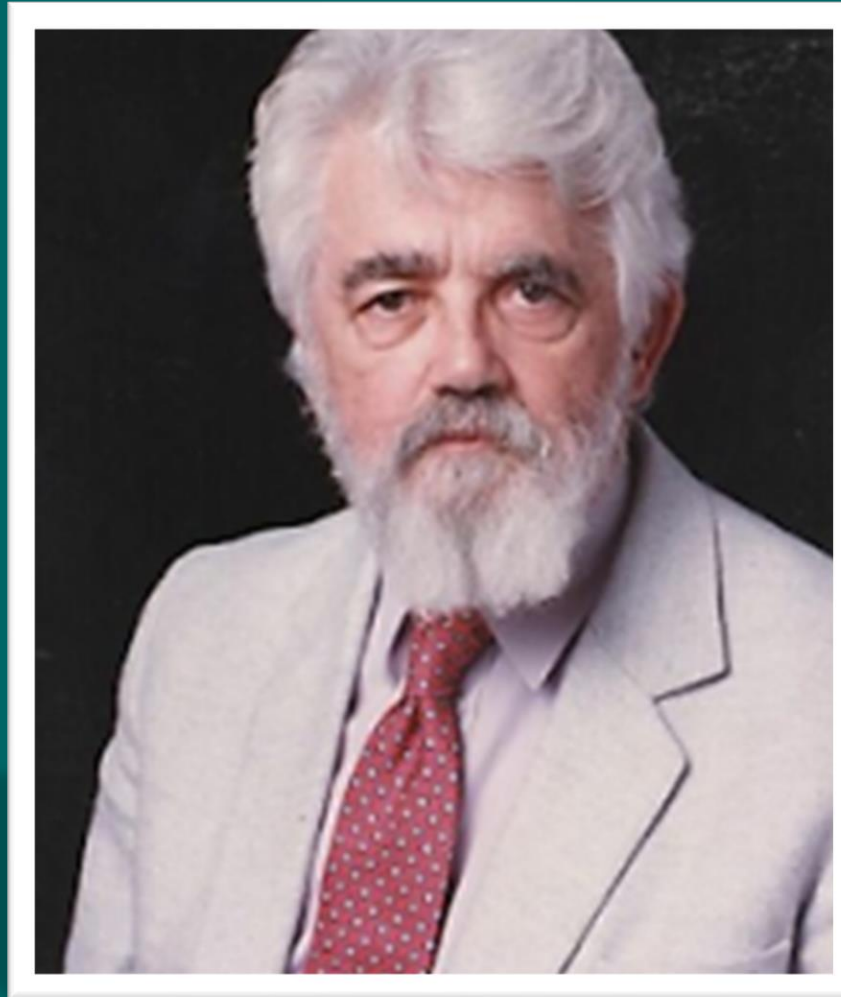
Example: Huong 10G5

You are to answer based on your prior knowledge (if any)

LINKING LESSON LEARNT

- **Previously**
You have learnt on the Automated & Emerging Technologies : Artificial Intelligence & Expert Systems
- **Today**
You will be building up your progress on Emerging Technologies on Machine Learning
- **What's next after this lesson.**
You will build more on Emerging Technologies with Past Papers & completion of Robotics & AI inference badges at idea.org.uk

WHO AM I



MACHINE LEARNING

It is a branch of artificial intelligence:

- Uses computing-based systems to make sense out of data
 - *Extracting patterns, fitting data to functions, classifying data, etc.*
- Machine Learning systems can learn and improve
 - *With historical data, time and experience*
- Bridges theoretical computer science and real noise data.

SUPERVISED & UNSUPERVISED LEARNING

59

Unsupervised Learning

- There are not predefined and known set of outcomes
- Look for hidden patterns and relations in the data
- A typical example: Clustering

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width
1	5.1	3.5	1.4	0.2
2	4.9	3.0	1.4	0.2
3	4.7	3.2	1.3	0.2
4	4.6	3.1	1.5	0.2
5	5.0	3.6	1.4	0.2
6	5.4	3.9	1.7	0.4
7	4.6	3.4	1.4	0.3
8	5.0	3.4	1.5	0.2
9	4.4	2.9	1.4	0.2
10	4.9	3.1	1.5	0.1



ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe the types and characteristics of machine learning

SUPERVISED & UNSUPERVISED LEARNING

60

Supervised Learning

- For every example in the data there is always a predefined outcome
- Models the relations between a set of descriptive features and a target (Fits data to a function)
- 2 groups of problems:
 - *Classification*
 - *Regression*

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STARTER

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PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

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SUPERVISED & UNSUPERVISED LEARNING

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OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

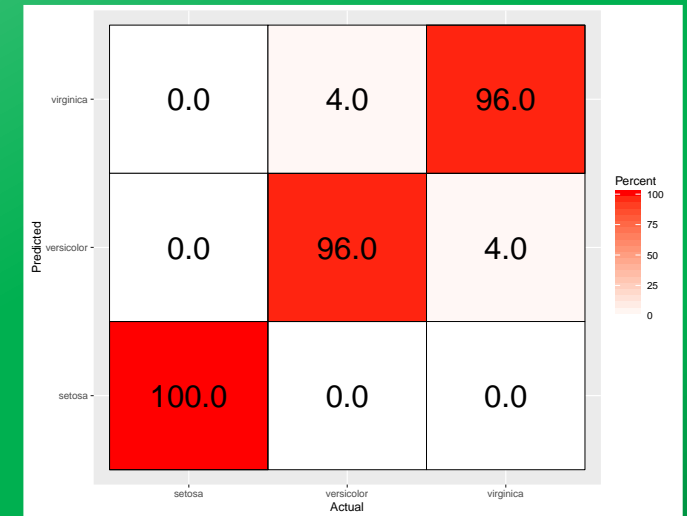
PLENARY

EXTENSION

- Classification
 - Predicts which class a given sample of data (sample of descriptive features) is part of (**discrete value**).

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	setosa
8	5.0	3.4	1.5	0.2	setosa
9	4.4	2.9	1.4	0.2	setosa
10	4.9	3.1	1.5	0.1	setosa

- Regression
 - Predicts continuous values.



ACTIVITY FOR ALL: HA / MA / LA

MACHINE LEARNING AS A PROCESS

62

TRIVIA

OBJECTIVES

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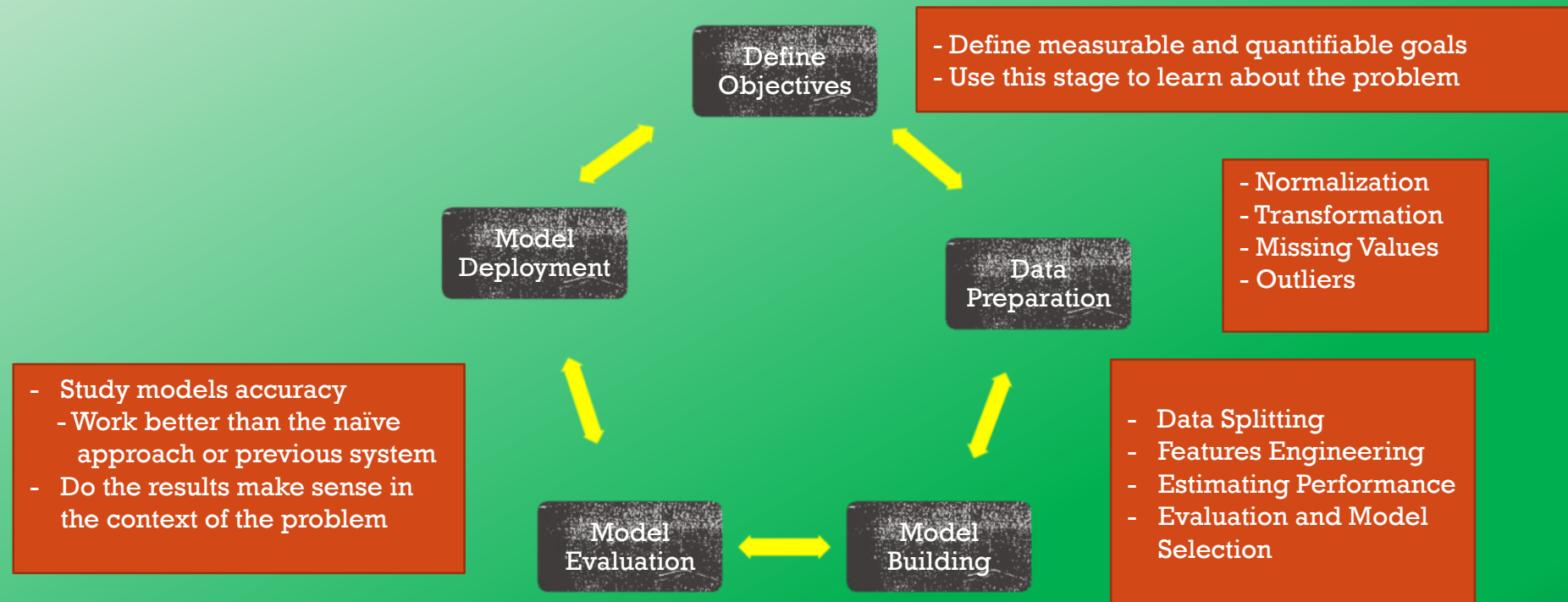
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PLENARY

EXTENSION



62

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe the types and characteristics of machine learning

MACHINE LEARNING AS A PROCESS

63

DATA PREPARATION

- Needed for several reasons
 - Some Models have strict data requirements
 - Scale of the data, data point intervals, etc
 - Some characteristics of the data may impact dramatically on the model performance
- Time on data preparation should not be underestimated



ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe the types and characteristics of machine learning

MACHINE LEARNING AS A PROCESS

Feature Engineering

- Determine the predictors (features) to be used is one of the most critical questions
- Sometimes we need to add predictors
- Reduce Number:
 - Fewer predictors more interpretable model and less costly
 - Most of the models are affected by high dimensionality, specially for non-informative predictors

PRESENTATION

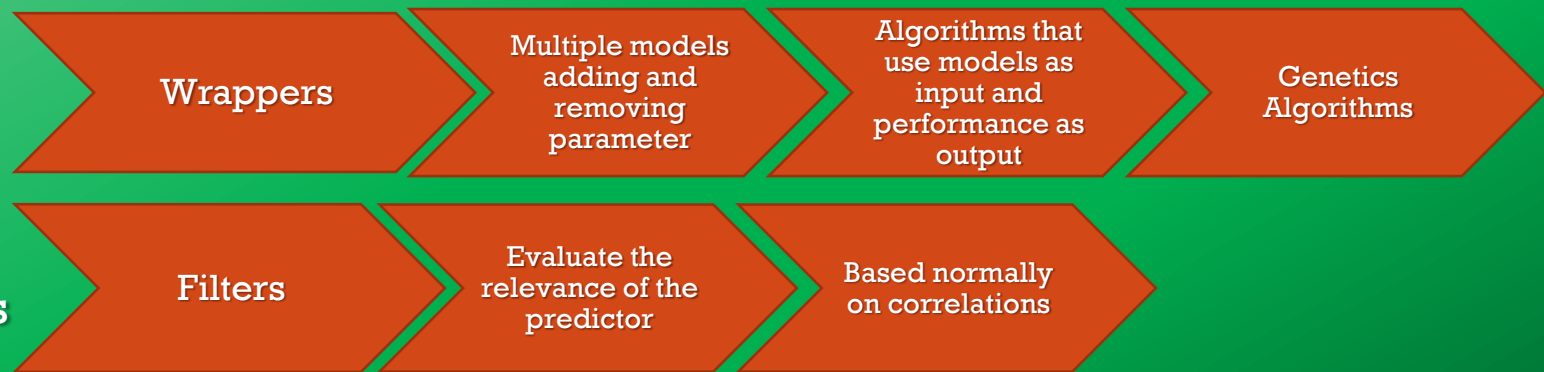
ACTIVITIES

PLENARY

EXTENSION

ACTIVITY FOR ALL: HA / MA / LA

Binning predictors



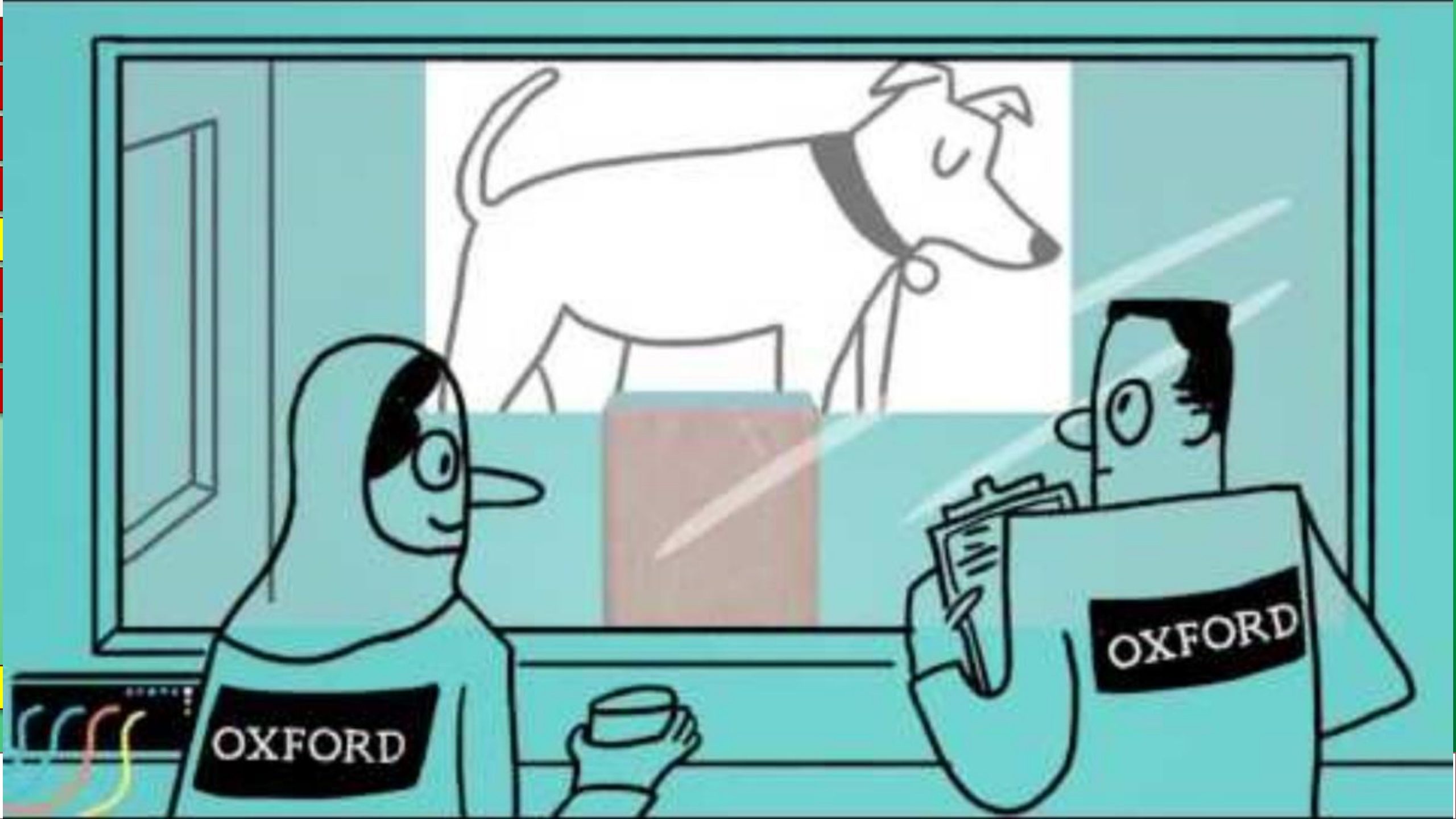
MACHINE LEARNING AS A PROCESS

65

- Data Splitting
 - Allocate data to different tasks
 - model training
 - performance evaluation
 - Define Training, Validation and Test sets
- Feature Selection (Review the decision made previously)
- Estimating Performance
 - Visualization of results – discovery interesting areas of the problem space
 - Statistics and performance measures
- Evaluation and Model selection
 - The 'no free lunch' theorem no a priori assumptions can be made
 - Avoid use of favorite models if NEEDED

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe the types and characteristics of machine learning



APPLICATIONS

MACHINE LEARNING

- *Computation Finance (Credit scoring, algorithmic trading)*
- *Computer Vision (Facial Recognition, Motion Tracking, Object detection.*
- *Natural Language processing (Voice recognition)*

ACTIVITY AFTER PRESENTATION

Idea.org.uk

You are to complete the following badges



ACTIVITY FOR ALL: HA / MA

Objective: Complete IDEA Badges: Chatbots, Robotics, and AI Inference



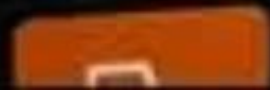
SQS



S3



DYNAMODB



This is My
Architecture
AWS

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

KNOWING WHAT YOU LEARNED

70

Go to :

<https://joinmyquiz.com>

Join code: 770036

Use your realname and grade level

Example: Huong 10G5

Follow instructions as this is a combined class grade levels.

EXTENSION ACTIVITY

- TRIVIA
- OBJECTIVES
- STARTER
- LINKING
- PRESENTATION
- ACTIVITIES
- PLENARY
- EXTENSION**

Question 6

A company is involved in robotics

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE 0478/12

Paper 1 Computer Systems February/March 2023

1 hour 45 minutes

(d) The robot needs to find its way through different puzzles. Each puzzle has a series of paths that the robot needs to follow to find its way to the end of the puzzle. The puzzle contains dead ends and obstacles, so the robot needs to decide which way to go.

The robot's program will use artificial intelligence (AI).

(i) Describe the characteristics of AI.

.....

.....

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.....

.....

..... [3]

(ii) Explain how the program will use AI.

.....

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.....

..... [4]

ACTIVITY FOR FAST LEARNERS : HA

EXTENSION ACTIVITY

TRIVIA

OBJECTIVES

STARTER

LINKING

PRESENTATION

ACTIVITIES

PLENARY

EXTENSION

Question 6 Markscheme

6(d)(i)	<p>Any three from: e.g.</p> <ul style="list-style-type: none"> • Collects data • Stores rules for using the data • The ability to reason • The ability to learn // uses machine learning • ... by adapting what it does • ... for example, from mistakes to not make them again // result from previous decisions impacts future • ... by changing its own rules • ...by changing its own data • ...by being trained • Makes one or more predictions (to make a decision) • Find/analyse patterns 	3
6(d)(ii)	<p>Four from: e.g.</p> <ul style="list-style-type: none"> • Use machine learning algorithms • Collects data about where it has been • Collect data about obstacles/problems • Store successful actions • Stores unsuccessful actions • Identify/store patterns • ... to make sure it does not repeat the same incorrect route • ... so, it knows how to react to obstacles next time • ...so, it knows what is most likely to work next time 	4

ACTIVITY FOR FAST LEARNERS : HA

This is the extended challenge activity for HA/MA

THANK YOU

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