

AI for Workforce

## **Facilitator Guide**

**Module 3: What is inside AI?**

Total Session Duration: 90 MINUTES

No. of Facilitators: 2

No. of Students: 40

**Facilitator Guide**

Dear Facilitators, this guide is meant to serve as a resource in conjunction with the slide deck to deliver the program in a standard manner. It includes different sections like activities guide, remote learning, and suggested reading material, etc. which provide tips and techniques to optimally deliver the program content. Please note that this guide need not be followed as is. Since you are the one who knows your students best, you are free to modify the content and make any necessary changes to suit the needs of your students.

|  |  |
| --- | --- |
| **Lesson Title:**  Module 3: What is inside AI? | **Approach:**  Facilitator-led Interactive Session |
| **Summary:**  Students will be provided a basic understanding of what is inside Artificial Intelligence. Students will be able to describe how decision making in AI works using perceptron. They will also learn to apply AI by using a no-code tool called Teachable Machine. | |
| **Learning Outcomes:**   1. Students demonstrate how AI makes decisions using Perceptron. 2. Students modify the working of a simple AI application using Teachable Machine tool. | |
| **Pre-requisites:**  Nil | |
| **Key-concepts:**   1. Decision making in AI 2. Perceptron | |
| **Material used:**   1. [Slides] Module 3 2. [Facilitator] Module 3 | |
| **AI Ethics issues discussed:**  Nil | |
| **Application to real life scenario [e.g. social issues, industry relevance, etc.]:**  Mask detection with Teachable Machine, for prevention of infectious disease | |

**1. Lesson Overview**

Note: The lesson overview gives an overall vision of how the sessions are timed for optimal delivery of content. It is to be noted that the session timings are not to be strictly followed and are only an estimate. You can deliver the sessions at your own pace in accordance with the class.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No** | **Time** | **Topic /Activity** | **Description** | **Objective** |
| 1 | 3 mins | Recap | Recap of previous module | Reiterate the highlights of previous module. |
| 2 | 17 mins | Intro to what is inside AI | Facilitator to give brief overview of what is Machine learning in general, and how decision is made (using perceptron). | Students will learn what is inside AI and various models in AI.  Students will demonstrate the decision-making process using Perceptron model. |
| Group Discussion and Sharing | Group discussion on how to make decision based on varying inputs. |
| 3 | 8mins | Intro to Teachable Machine | Brief intro to Teachable Machine. | Learn to create and modify AI application using Teachable Machine |
| 15 mins | Create demo though group activity | Each group will be assigned a task using Teachable Machine:  1. Mask vs no-mask.  2. Two different persons-facial recognition.  3. Different phone models.  4. Stationery. |
| 15 mins | Explore other group’s demos | Each group explore what the other groups have done. |
| 4 | 2 mins | Reflection | Summarize the learning objectives and key concepts for this lesson. | Reiterate the learning objectives of this module. |

**2. Session Preparation**

Slides: [Slides] Module 3

Logistics: For a class of 40

|  |  |
| --- | --- |
| **Item** | **Quantity** |
| Laptops | 20 |
| Stationery (Red Pen, Blue Pen, etc. for demo with Teachable Machine) | 4 each |

**3. Activities Guide**

Note: The activities guide lays down sample guidelines on how to interact with the students and deliver the contents in the slide deck. You are welcome to modify any of the slide notes, suggestions for better delivery of content.

*[Slide 1 to 3] Reiterate the highlights of previous module [3 minutes]*

The purpose of this section is to reiterate what the student has previously learned.

*[Slide 1]*

Welcome back to the AI for Future Workforce program. Today we are discussing Module 3 What is inside AI?

*[Slide 2]*

Legal Disclaimer

*[Slide 3]*

Before we proceed with Module 3, let us recap what we have learned in the previous module.

We learnt about features and functions of AI.

We learnt about artificial general intelligence and artificial narrow intelligence.

Further we had a look of various case studies of AI

And we looked into what is AI and what is Not AI.

*[Slide 4 to 25] What is inside AI [17 minutes]*

The purpose of this section is to establish students’ foundational understanding of what is happening inside AI.

*[Slide 4]*

ML is a subset of AI. Not all AI is ML.

DL is a subset of ML. Not all ML is DL.

*[Slide 5]*

AI is not magic. AI is made from logic.

As you can see in the picture, there many mathematical formulas. In the same way, AI makes decision based on a series of mathematical formulas and applies it to a problem.

AI is about making logical decisions, based on the information that it receives.

*[Slide 6]*

To say it briefly:

* In classical programming, rules are explicitly programmed for the machine.
* In machine learning, rules are created from the machine learning algorithm.

Machine learning is the study of computer algorithms that make predictions based on existing data. It aims to find patterns in vast amounts of data by using statistics to create rules for decision making. This is why we say the rule has been created not explicitly programme.

*[Slide 8]*

Machine learning models are programs that have been taught to recognize patterns in fresh data and anticipate outcomes. These models are modelled as a mathematical function that receives requests in the form of input data, processes that data to create predictions, and then returns an output. These models are first trained using a collection of data, and then an algorithm is given to them so they may analyze the data, find patterns, and learn from the data. These models can be used to forecast the unknown dataset once they have been trained.

*[Slide 9]*

Some of the popular Machine Learning algorithms used in Supervised learning are Linear Regression, Naïve Bayes, Neural Networks, Support Vector Machine, Random Forest Algorithm

*[Slide 10]*

Examples of Machine Learning algorithms:  K-Means Clustering, Principal Component Analysis and Hierarchical Clustering.

*[Slide 13]*

What you are seeing right now is just part of a list of all the AI models out there.

Some of the popular models include:

* Decision Tree.
* Linear Regression.
* K-Nearest Neighbor (kNN).
* And, Random Forest.

*[Slide 15]*

What you are seeing right now is just part of a list of all the AI models out there.

For this lesson, we will just learn one model. We will learn a very simple model call Perceptron.

Can you find where is the perceptron in Figure 1?

*Note to Facilitator: Inside the table, it is on the left, under Neural Networks.*

*(There is animation for this slide.)*

*[Slide 16]*

Let's say you want to go out to the park today. What would be your thought process? What would you consider?

Most of us would want to avoid getting soaked in the rain. These are possible factors that may influence your decision whether to go out. So, the first question that you may ask is, “Should I bring a rain jacket?”

Then, you may also ask, “Should I bring an umbrella?”

Or you may also ask, “What is the weather now?”

And finally, “What will the weather be like, later in the day?”

*[Slide 17]*

Now, you have the factors that will influence your decision to go out.

But take note, not all factors are equal. Some factors are more important, while some are not.

Let's see which one is more important.

Let us rank them from the most important to the least important

For me, “is it sunny now” is more important than “the weather forecast later”. And “having a jacket” is more important than “having an umbrella. We can put the ranking for this example.

Now let us convert this to perceptron.

*(There is animation for this slide.)*

*[Slide 18]*

Before we continue with the earlier example, let us learn what is a perceptron.

Perceptron is a simple logic.

With some conditions (we can call these conditions input, reasons, factors), you will perform some simple arithmetic calculation to them, and finally with the output of the calculation, you will determine its results.

*[Slide 19]*

The very simple model of perceptron is just to add all the inputs.

To start with, let us look at what is “input” in a perceptron.

What are inputs? Inputs can be factors, reasons, conditions, in the decision-making process etc.

In the example just now, the inputs would be factors or conditions such as: do I have a jacket, do I have an umbrella, is it sunny etc.

We will add all the inputs (we will name it X1, X2, X3, and so on)

*[Slide 20]*

But each input is not equal.

Some are more important; some are less important. Deciding on the values is based on experience, preference and relevance to the situation.

That is why we introduce the weights here. A factor that is more important will have a larger weight. They are denoted with the symbol W.

Instead of just adding all the input, we now have a weighted input.

Weighted input means the input multiplied with their own weights, just like in the formula.

*[Slide 21]*

Now, if we add all the inputs and the weights, the sum will always be a positive value.

For a simple decision, it is either a yes or a no. If we take positive value as yes, and negative value as no, we can never get an answer No as the value is always positive.

Therefore, we must have the possibility of summation to be negative. Therefore, we introduce bias. Bias helps to bring the number down. In this diagram, bias is shown as w0. In our exercise later, we will use WB. Please take note.

*[Slide 22]*

After we get the values (from input and from bias), what do we do with it?

We will determine the outcome based on the summation of both the weighted input and weighted bias. If it is a positive number, then it is a Yes. If it is a negative number, it is a No. So, we are using zero (0) as a threshold. So, we are using zero (0) as a threshold. This is a step function. Any values below the threshold will be assigned low, which correspond to No. Any values above the threshold will be assigned high, which correspond to Yes.

*[Slide 23]*

Going back to the earlier example, we have four inputs.

So, let’s draw the perceptron with four inputs (from X1 to X4). *(Animation on mouse click.)*

Next, we have their weights (from W1 to W3). *(Animation on mouse click.)*

Then, we also have the bias B, with weight WB. *(Animation on mouse click.)*

Finally, we sum them all up, compare with threshold, and we will get our output. *(Animation on mouse click.)*

(There is animation for this slide.)

*[Slide 24]*

Now we will fill in the four inputs with the factors that we have listed out.

* Do I have a jacket?
* Do I have umbrella?
* Is it sunny now?
* What is the weather forecast for later?

*[Slide 25]*

Now we will fill in the importance. But the importance is not very useful in mathematical calculations.

Next, let us assign some numbers to them. At the same time, we will also assign a number for the bias weight (WB).

*[Slide 26]*

How do we know what should be the actual values for the weights? We will not know what are the actual weights.

However, we can make some assumptions.

The values for the weights can come from experience. He may have an experience being sunny now would most likely mean a bright day ahead, hence the high importance there.

It can also come from personal preference. A person may judge a particular factor more heavily as compared to another person. For example, she may be more concerned with the weather forecast, hence the higher importance there.

The values for WB are also based on personal preference. If a person is more cautious, he may set the value for WB to be higher, hence his decision would gear towards staying indoors unless he is sure that it would not rain. On another hand, a person who is more daring will have a lower WB, hence he is more likely to go out regardless of the current situation. In this example, we choose 4 as we want to be more cautious.

Therefore, there is no right or wrong answers in coming up with the values for the weights. However, the effects of the values will determine the outcome that the person is going to take, whether to go out or not. That is the reason why everyone comes up with a different decision, even though the situation is the same for everyone.

*[Slide 27]*

For this example, let’s say: I have a jacket, I don’t have an umbrella, it is sunny now, and the weather forecast is going to rain.

We can convert the yes and no to numbers 1 and 0. For bias, we will always take 1.

*[Slide 28]*

From this calculation, the output is 0.5.

Since this is higher than the threshold (which is zero), the result is I will go out to the park.

*[Slide 29]*

Now let us change for another example. For this example, let’s say: I don’t have a jacket, I have an umbrella, it is not sunny now, and the weather forecast is ok. We will convert the yes and no to numbers 1 and 0. And similarly, for bias, we will take 1.

*[Slide 30]*

From this calculation, the output is -0.5.

Since this is lower than the threshold (which is zero), the result is I will not go out to the park.

*[Slide 31]*

Ok, we have gone through a simple exercise just now. Now is your turn. Please form into 4 groups. You will do something similar, like what I have done just now. Find the factors that are relevant to your problem, figure out their importance and their weights, sum them all up, and finally determine what are your decisions based on the threshold. You have 15 minutes to do all these 3 questions.

(Show slide 17 if they need to refer.)

*[Slide 32]*

Each group will have 3 minutes to present on the three questions.

Group 1, please begin.

(To repeat the same steps for the other groups.)

*[Slide 39]*

After watching the short introduction, it is time for some hands-on. Can you Google search the word “Teachable Machine”?

In this example, we will use the image project. Select image project

We will do a comparison of a red pen and a blue pen.

(Facilitator has two options on how to deliver this section:

1. You can go through all the slides (slide 26 to slide 29) and then do a demo.
2. You can conduct the demo directly to the class, without going through the slides 26 to 29.)

*[Slide 42]*

For Class 1, rename it to Blue Pen.

*[Slide 43]*

For Add Image Samples, we will be using the webcam to capture the images of the Blue Pen.

*[Slide 44]*

Click “Hold to record”. It takes multiple images.

For best performance, you should have at least 50 images. The images should be different; therefore, you need to twist and turn the pen around.

After you are done, unclick and remember to close the box (X).

*[Slide 45]*

Now, repeat steps 2 to 4, for Class 2. This time, for class 2, let’s rename it to Red Pen. Use the webcam to take the photos of a Red Pen.

*[Slide 46]*

Now, we will repeat the steps 2 to 4, again. This time, it is for the time when there is no pen.

For this, we will take the photo of the background.

*[Slide 47]*

Remember to close the box in webcam.

Now click on “Train model”. You will see “preparing training data”.

*[Slide 48]*

After the training is done, you will see the webcam is turn on, where you can preview your model. You can test it out with a red pen or a blue pen.

*[Slide 50]*

Ok, time up. For the next 15 minutes, explore what your friends have created in the other groups.

*[Slide 51]*

Let us recap what we have learnt so far.

Today we have learned how AI works. And there are many ways AI can make decisions. And for that, we learn a basic AI model.

Do you still remember the name of the basic AI model that we have gone through? *(Perceptron)*

We also learn how to use Teachable Machine to perform everyday tasks. You have learnt that it can detect many things. For example, whether a person is wearing a mask. Another example is to detect if that is a red pen or a blue pen, etc.

You can further explore on your own, on what you can do with Teachable Machine in your daily lives.

*[Slide 52]*

Thank you for your contribution today. I look forward to the next session with all of you.

**4. Troubleshooting Tips**

Common Hardware Mistakes/ Issues

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Mistakes/ issues** | **Possible reasons** | **Resolution** |
|  | - | - |  |

**5. Remote Learning**

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| --- | --- | --- |
| **Activity** | **Key Differences** | **Remote Facilitation Tips** |
| Group discussion and creating demo | Instead of working in groups, students will have to do the activity individually. Questions for “what is AI” may need to reduce, depending on individual students’ progress | More time required for the students to practice, and ask question. |

**6. Blended Learning for Students**

|  |  |  |
| --- | --- | --- |
| **Activity** | **Description** | **Recommended Time** |
| Readings | Basic information on perceptron: <https://towardsdatascience.com/power-of-a-single-neuron-perceptron-c418ba445095> | 15 minutes |

**7. Suggested Reading for Facilitators**

|  |  |  |
| --- | --- | --- |
| **Material Suggested** | **Links** | **Recommended Usage** |
| How Does AI Work? | <https://www.youtube.com/watch?v=L_9OluD0nqw> | General viewing of how AI works, with explanation on perceptron. |

**8. Bibliography**

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