

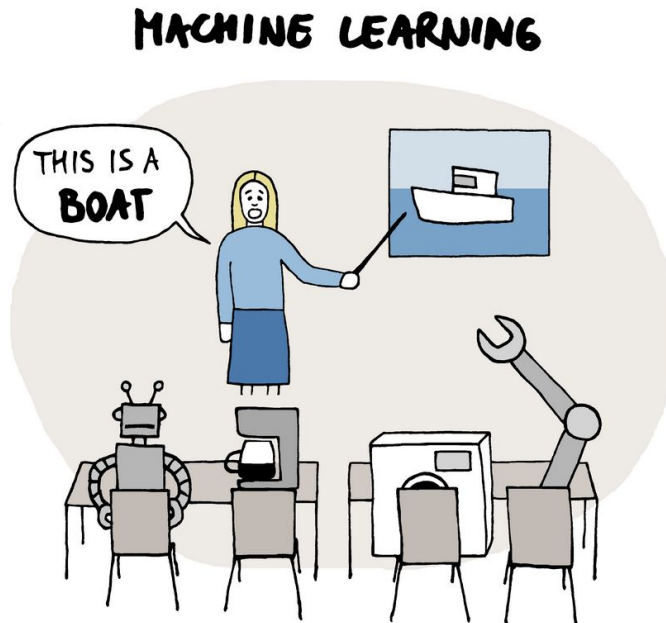
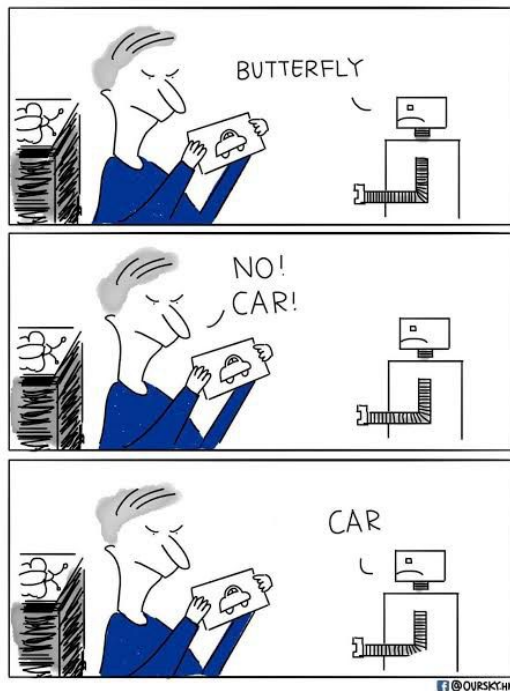
Demonstration session for Image Classification

Nyi Nyi Soe

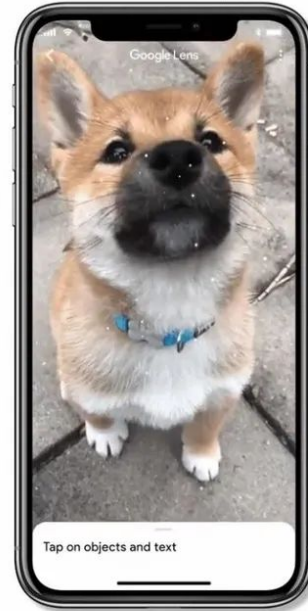
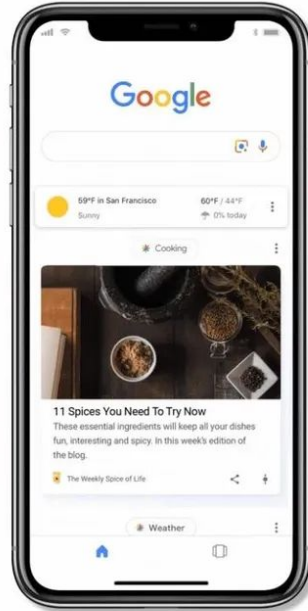
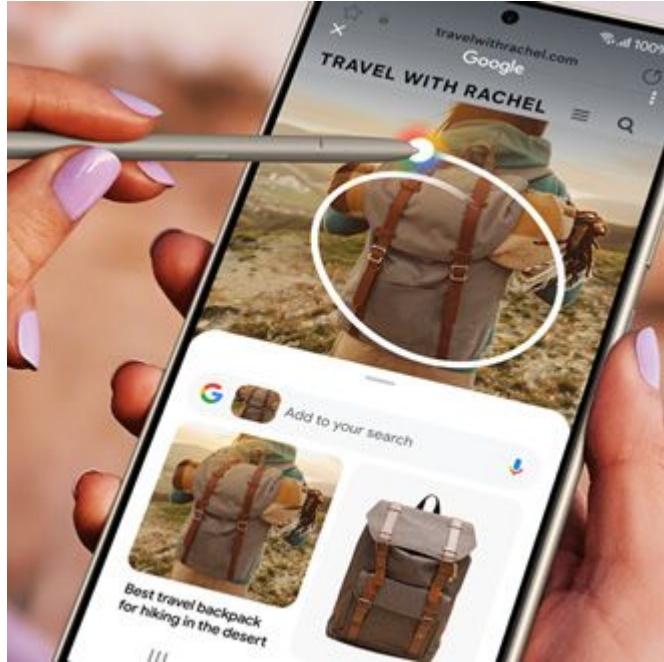
MBBS, MPH, PhD Candidate

What is Image Classification?

Let's start a **teaching** to a robot



What is Image Classification?



Write many lines of python codes

```
<div>Teachable Machine Image Model</div>
<button type="button" onclick="init()">Start</button>
<div id="webcam-container"></div>
<div id="label-container"></div>
<script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@latest/dist/tf.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/@teachablemachine/image@latest/dist/teachablemachine-image.min.js"></script>
<script type="text/javascript">
  // More API functions here:
  // https://github.com/googlecreativelab/teachablemachine-community/tree/master/libraries/image

  // the link to your model provided by Teachable Machine export panel
  const URL = "{{URL}}";

  let model, webcam, labelContainer, maxPredictions;

  // Load the image model and setup the webcam
  async function init() {
    const modelURL = URL + "model.json";
    const metadataURL = URL + "metadata.json";

    // load the model and metadata
    // Refer to tmImage.loadFromFiles() in the API to support files from a file picker
    // or files from your local hard drive
    // Note: the pose library adds "tmImage" object to your window (window.tmImage)
    model = await tmImage.load(modelURL, metadataURL);
    maxPredictions = model.getTotalClasses();

    // Convenience function to setup a webcam
    const flip = true; // whether to flip the webcam
    webcam = new tmImage.Webcam(200, 200, flip); // width, height, flip
    await webcam.setup(); // request access to the webcam
    await webcam.play();
    window.requestAnimationFrame(loop);

    // append elements to the DOM
    document.getElementById("webcam-container").appendChild(webcam.canvas);
    labelContainer = document.getElementById("label-container");
    for (let i = 0; i < maxPredictions; i++) { // and class labels
      labelContainer.appendChild(document.createElement("div"));
    }
  }
}
```

```
<div>Teachable Machine Image Model - p5.js and ml5.js</div>
<script src="https://cdn.jsdelivr.net/npm/p5@latest/lib/p5.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/p5@latest/lib/addons/p5.dom.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/ml5@latest/dist/ml5.min.js"></script>
<script type="text/javascript">
  // Classifier Variable
  let classifier;
  // Model URL
  let imageModelURL = '{{URL}}';

  // Video
  let video;
  let flippedVideo;
  // To store the classification
  let label = "";

  // Load the model first
  function preload() {
    classifier = ml5.imageClassifier(imageModelURL + 'model.json');
  }

  function setup() {
    createCanvas(320, 260);
    // Create the video
    video = createCapture(VIDEO);
    video.size(320, 240);
    video.hide();

    flippedVideo = ml5.flipImage(video);
    // Start classifying
    classifyVideo();
  }

  function draw() {
    background(0);
    // Draw the video
    image(flippedVideo, 0, 0);
  }
}
```

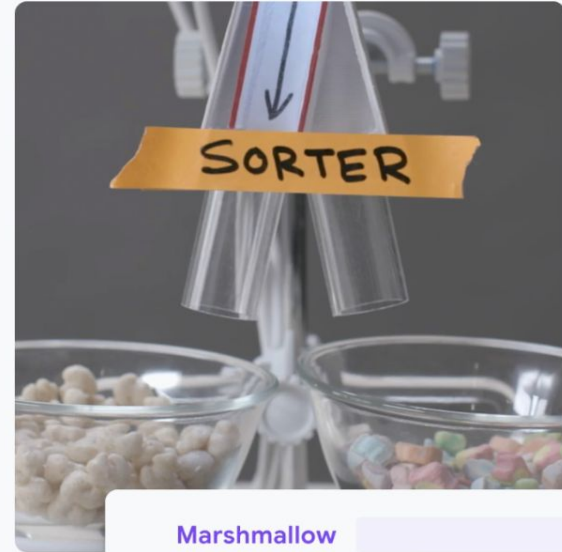
<https://teachablemachine.withgoogle.com/>

Teachable Machine

Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

Get Started



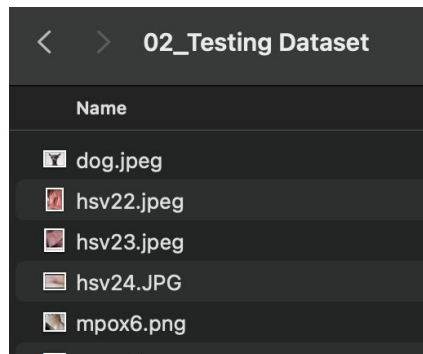
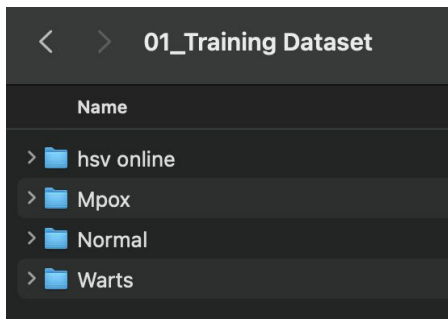
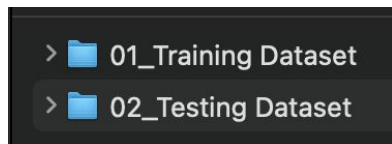
Marshmallow

Not Marshmallow

100%

Prerequisite

- Need **Internet** Access
- **Download the Images** to your device



Step 1: Uploading Images

Teachable Machine

The screenshot displays the Teachable Machine interface. On the left, there are two class cards: 'Class 1' and 'Class 2'. Each card has a title, an edit icon, and a vertical menu icon. Below the title is the text 'Add Image Samples:'. Underneath, there are two buttons: 'Webcam' and 'Upload'. The 'Upload' button in the 'Class 1' card is highlighted with a red rectangular box. Below the class cards is a dashed box containing the text 'Add a class'. To the right of the class cards is a 'Training' panel with a 'Train Model' button and a dropdown menu currently set to 'Advanced'. Further right is a 'Preview' panel with an 'Export Model' button and a message: 'You must train a model on the left before you can preview it here.'


Step 1: Uploading Images


Teachable Machine

The screenshot displays the Teachable Machine interface. On the left, there are two class cards: 'Class 1' and 'Class 2'. Each card has a title, an edit icon, and a menu icon. Below the title is the text 'Add Image Samples:'. Underneath, there are two buttons: 'Webcam' and 'Upload'. A pink arrow points to the 'Upload' button in the 'Class 1' card. Below the class cards is a dashed box with the text 'Add a class'. To the right of the class cards is the 'Training' section, which contains a 'Train Model' button and an 'Advanced' dropdown menu. Further right is the 'Preview' section, which contains an 'Export Model' button and a message: 'You must train a model on the left before you can preview it here.'


Step 1: Uploading Images

Teachable Machine


Class 1 

File  Add Image Samples:



Choose images from your files, or drag & drop here


Import images from Google Drive 

Images will be cropped to square

Class 2 


Add Image Samples:


Webcam  Upload 

 Add a class

Training

Train Model


Advanced 


Preview  Export Model

You must train a model on the left before you can preview it here.

Step 1: Uploading HSV Images





Teachable Machine

Class 1 


File  Add Image Samples:

Choose images from your files, or drag & drop here



Import images from Google Drive


  →  

Images will be cropped to square


Class 2 


Add Image Samples:


 Webcam  Upload

 Add a class

Training

 Train Model

Advanced 

Preview  Export Model

You must train a model on the left before you can preview it here.

Step 1: Uploading Images

The screenshot displays the Teachable Machine interface. On the left, there are two class cards: 'Class 1' and 'Class 2'. The 'Class 1' card is highlighted with a red rectangular box. Each class card has a header with the class name and an edit icon, followed by a section titled 'Add Image Samples:' containing 'Webcam' and 'Upload' buttons. Below the class cards is a dashed box labeled 'Add a class'. To the right of the class cards is a 'Training' panel with a 'Train Model' button and an 'Advanced' dropdown menu. Further right is a 'Preview' panel with an 'Export Model' button and a message: 'You must train a model on the left before you can preview it here.'

Step 1: Repeat uploading other disease classes


Herpes ✎

File X 21 Image Samples

Choose images from your files, or drag & drop here

Import images from Google Drive

Images will be cropped to square



Class 2 ✎

Add Image Samples:

Webcam Upload

Add a class

Training

Train Model

Advanced

Preview

Export Model

You must train a model on the left before you can preview it here.

Step 2: Training

Teachable Machine

21 Image Samples



Webcam



Upload



Mox

27 Image Samples



Webcam



Upload



Normal

32 Image Samples



Webcam



Upload



Warts

File



21 Image Samples

Choose images from your files,
or drag & drop here

Import images from
Google Drive



Training

Train Model

Advanced



Epochs: 50



Batch Size: 16



Learning Rate:

0.001



Reset Defaults



Under the hood



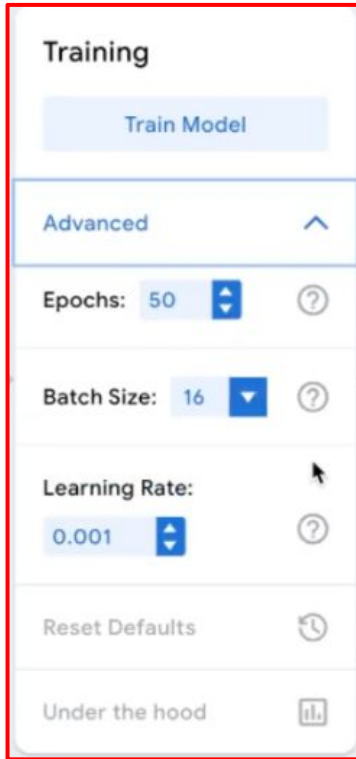
Preview



Export Model

You must train a model on the left
before you can preview it here.

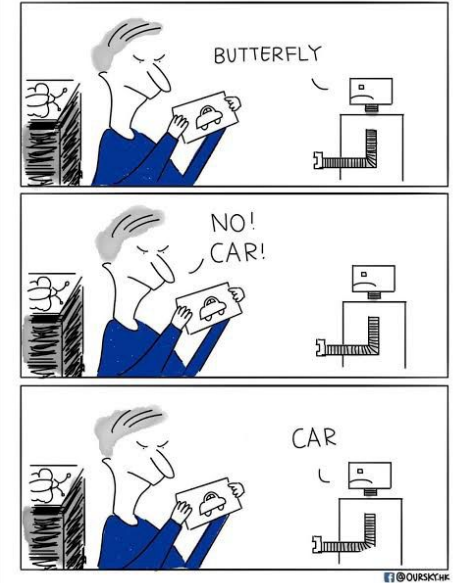
Step 2: Training



Epochs

One epoch: each and every images in the training has been used through training model model at least once.

50 epochs: training with entire dataset x 50 times

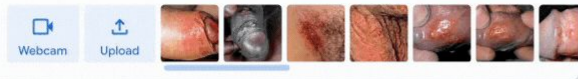


Step 2: Training

Teachable Machine

herpes

21 Image Samples



Mpox

27 Image Samples



Normal

32 Image Samples

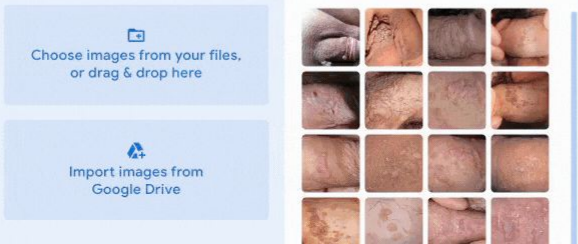


Warts

File X 21 Image Samples

Choose images from your files, or drag & drop here

Import images from Google Drive



Training

Train Model

Advanced

Epochs: 50

Batch Size: 16

Learning Rate:

0.001

Reset Defaults

Under the hood

Preview

Export Model

You must train a model on the left before you can preview it here.


Step 2: How does it learn?



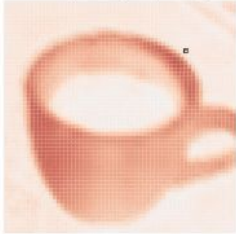
Step 2: Training

Convolution

Input (64, 64)



Output (62, 62)



0.12 + 0.12 + 0.11 +
x -0.25 x -0.22 x 0.01 +
0.13 + 0.14 + 0.13 +
x -0.17 x -0.26 x -0.03 +
0.14 + 0.14 + 0.13 =
x -0.15 x -0.02 x -0.21

$\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{bmatrix}$

Hover over the matrices to change kernel position.

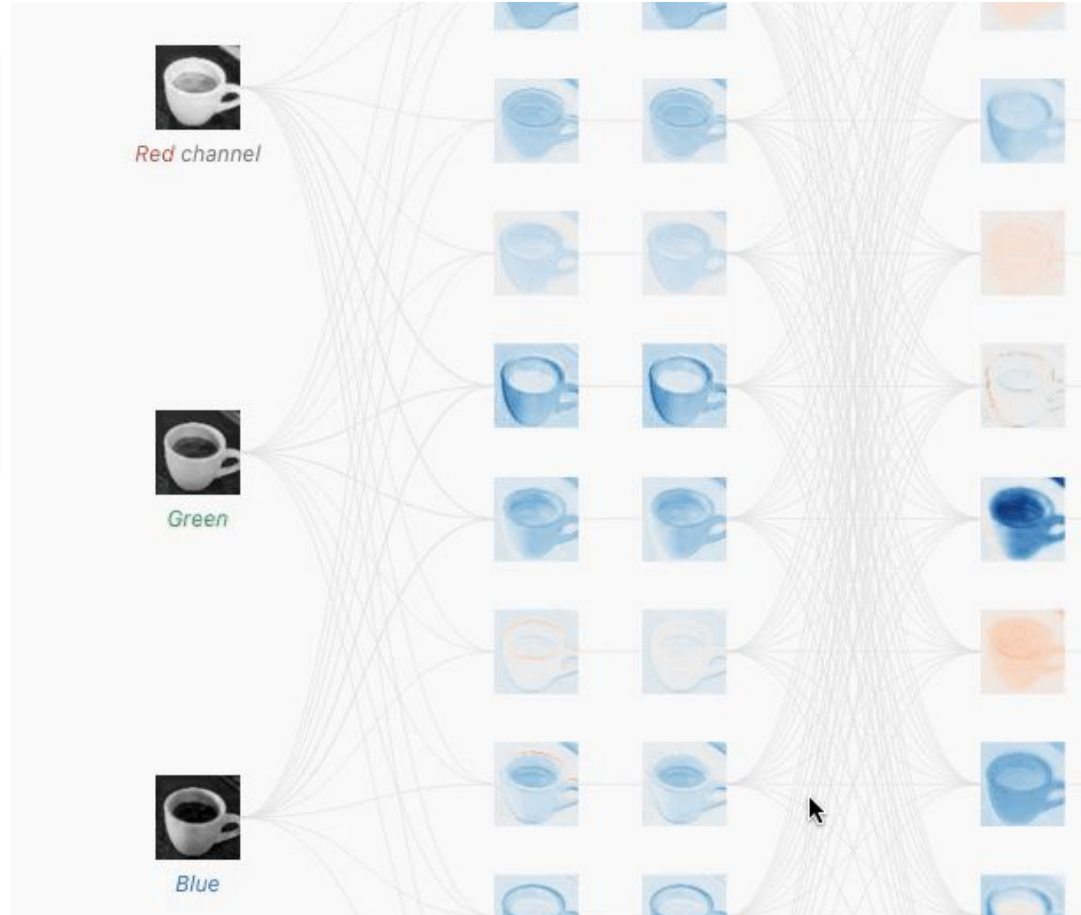
Computer vision vs human vision



What we see


0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

What a computer sees







Step 3: Interpretations

Teachable Machine




Herpes  ⋮


21 Image Samples

 Webcam  Upload 




Mpox  ⋮


27 Image Samples

 Webcam  Upload 




Normal  ⋮

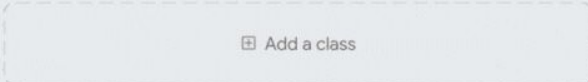
32 Image Samples

 Webcam  Upload 

Warts  ⋮


21 Image Samples



 Webcam  Upload 







Training


Model Trained


Advanced 

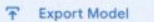
Epochs: 50  


Batch Size: 16  

Learning Rate: 0.001  

Reset Defaults 


Under the hood 

Preview 

Input ON 


Choose images from your files, or drag & drop here

Import images from Google Drive





Output

Herpes	<div style="width: 0%;"></div>
Mpox	<div style="width: 79%;"></div> 79%
Normal	<div style="width: 21%;"></div> 21%
Warts	<div style="width: 0%;"></div>








English  release-2-4-7 - 2.4.7P5b5b73



Step 3: Interpretations

Teachable Machine








Herpes  



21 Image Samples

Webcam Upload       








Mpox  



27 Image Samples

Webcam Upload       








Normal  


32 Image Samples

Webcam Upload       

Warts  


21 Image Samples



Webcam Upload       



 Add a class



Training


Model Trained


Advanced 


Epochs: 50  

Batch Size: 16  

Learning Rate: 0.001  

Reset Defaults 


Under the hood 

Preview  Export Model


Input ON File


Choose images from your files or drag & drop here


Import images from Google Drive

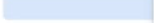


Output

Herpes 


Mpox  79%


Normal  21%

Warts 


Here are a few graphs that can help you understand how well your model is working.

Don't worry if this doesn't make sense at first—you don't need to use any of this to use Teachable Machine and, in fact, most people don't :)

Vocab 


Accuracy per class 


CLASS	ACCURACY	# SAMPLES
Herpes	1.00	4
Mpox	0.80	5
Normal	1.00	5
Warts	0.75	4

Confusion Matrix 

Class	Herpes	Mpox	Normal	Warts
Herpes	4	0	0	0
Mpox	0	4	1	0
Normal	0	0	5	0
Warts	1	0	0	3

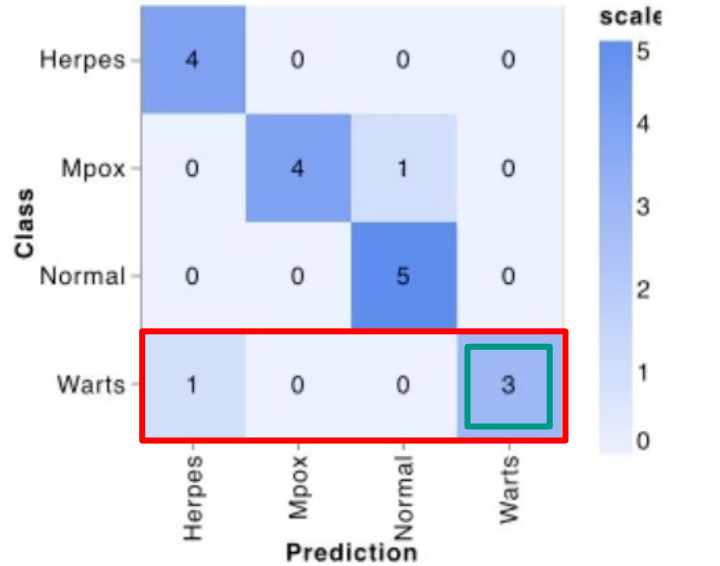
scale 5 4 3 2 1 0

Accuracy per epoch 



Step 3: Interpretations

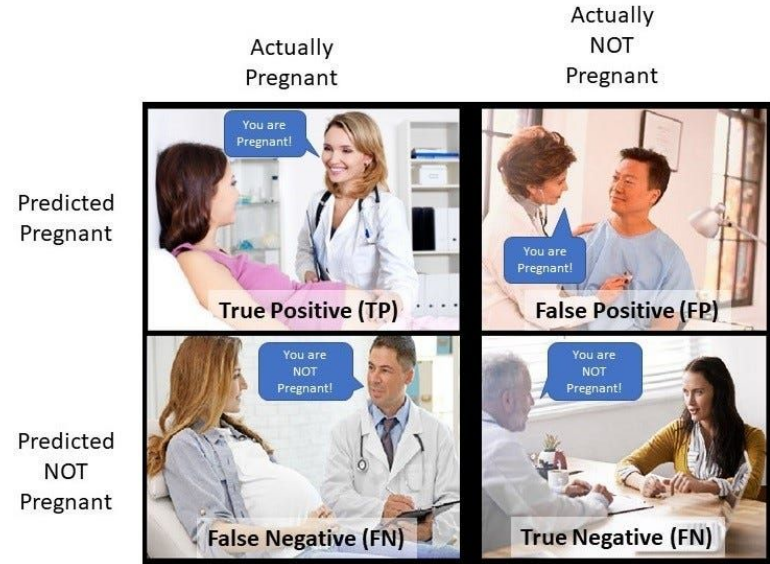
Confusion Matrix



Actual Warts = 4

AI classification for Warts = 3 out of all tested images

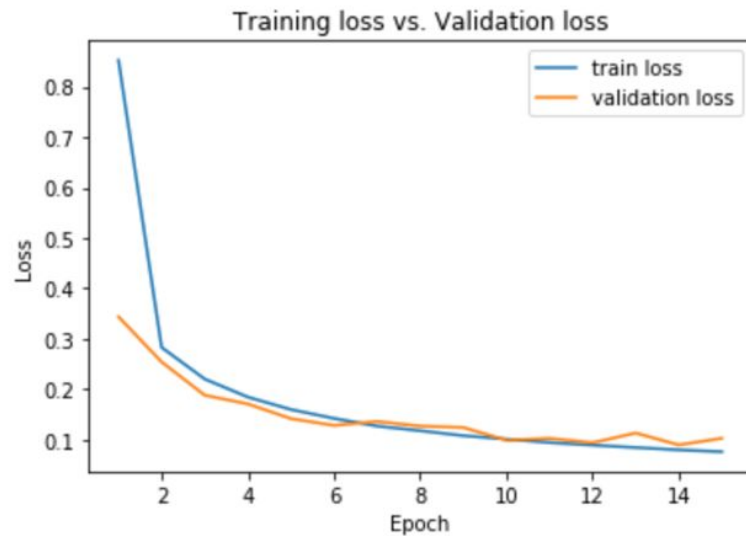
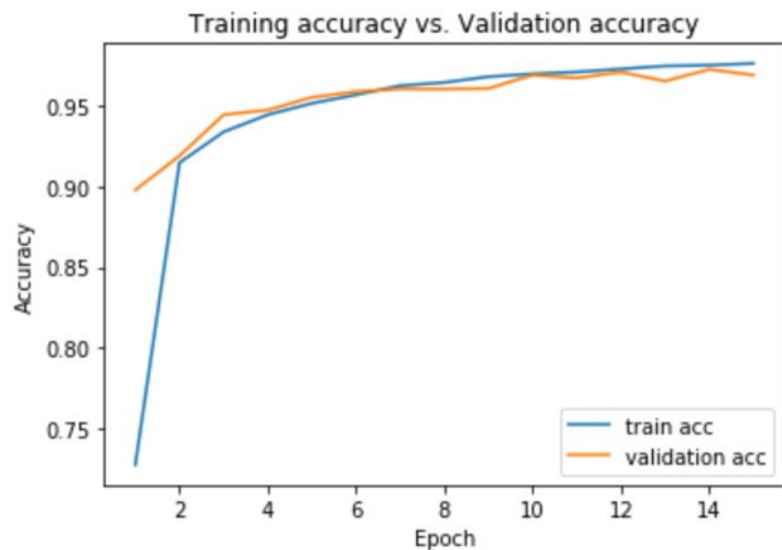
AI Accuracy for Warts = $\frac{3}{4} = 75\%$



Confusion Matrix



Accuracy per class		
CLASS	ACCURACY	# SAMPLES
Herpes	1.00	4
Mpox	0.80	5
Normal	1.00	5
Warts	0.75	4

Step 3: Interpretations








Step 4: Testing with unseen images

Teachable Machine




Herpes  



21 Image Samples

 Webcam  Upload 




Mpox  



27 Image Samples

 Webcam  Upload 




Normal  

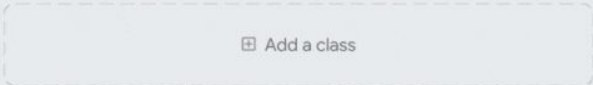
32 Image Samples

 Webcam  Upload 

Warts  


21 Image Samples



 Webcam  Upload 







Training


Model Trained


Advanced 


Epochs: 50  


Batch Size: 16  

Learning Rate: 0.001  

Reset Defaults 


Under the hood 

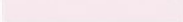
Preview  [Export Model](#)

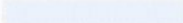
Input ON Webcam 


There was an error opening your webcam. Make sure permissions are enabled or switch to image uploading.


Output

Herpes 

Mpox 

Normal 

Warts 

English  release-2-4-7 - 2.4.7#5b5b73

Step 4: Testing with unseen images

Teachable Machine

Herpes 21 Image Samples

Webcam Upload

Mpox 27 Image Samples

Webcam Upload

Normal 32 Image Samples

Webcam Upload

Warts 21 Image Samples

Webcam Upload

Add a class

Training

Model Trained

Advanced

Epochs: 50

Batch Size: 16

Learning Rate: 0.001

Reset Defaults


Under the hood

Preview Export Model

Input ON File

Choose images from your files, or drag & drop here

Import images from Google Drive



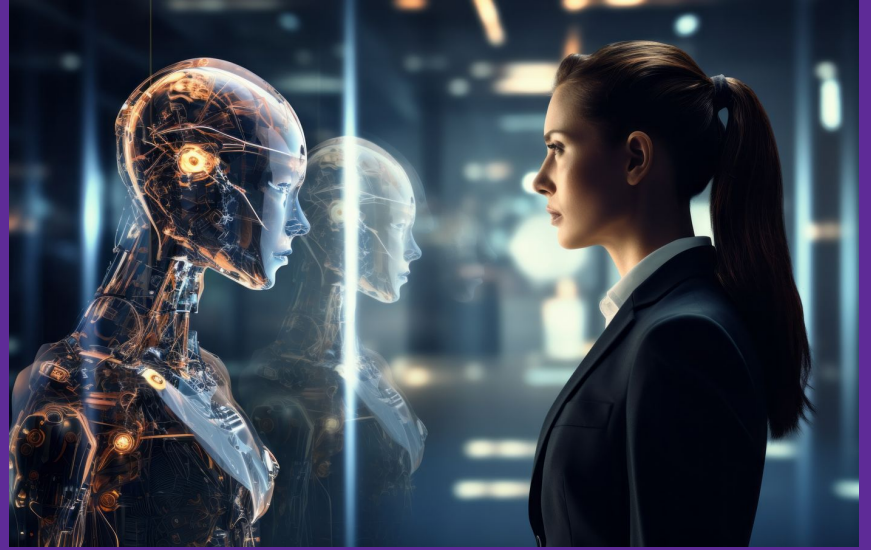
Output

Herpes	
Mpox	98%
Normal	
Warts	

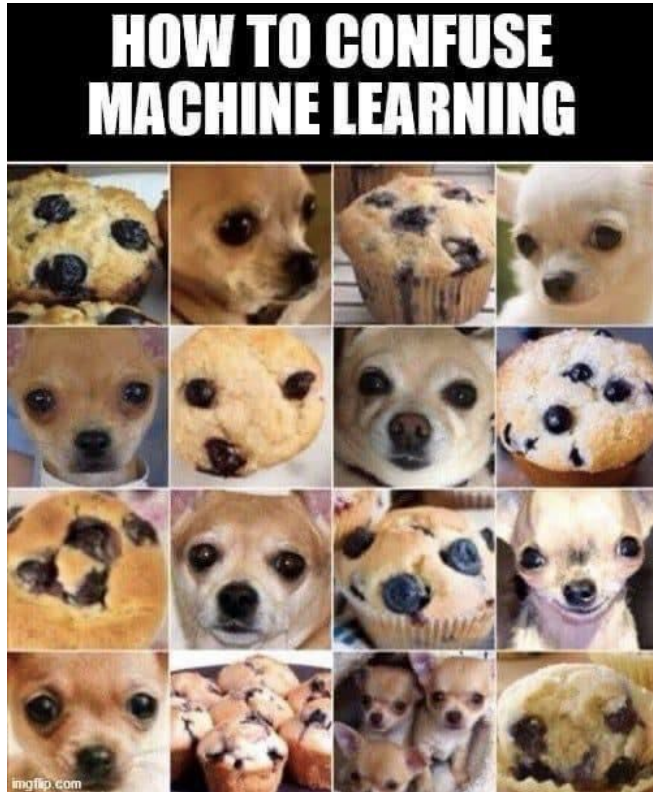
English

release-2-4-7 - 2.4.7#5b5b73

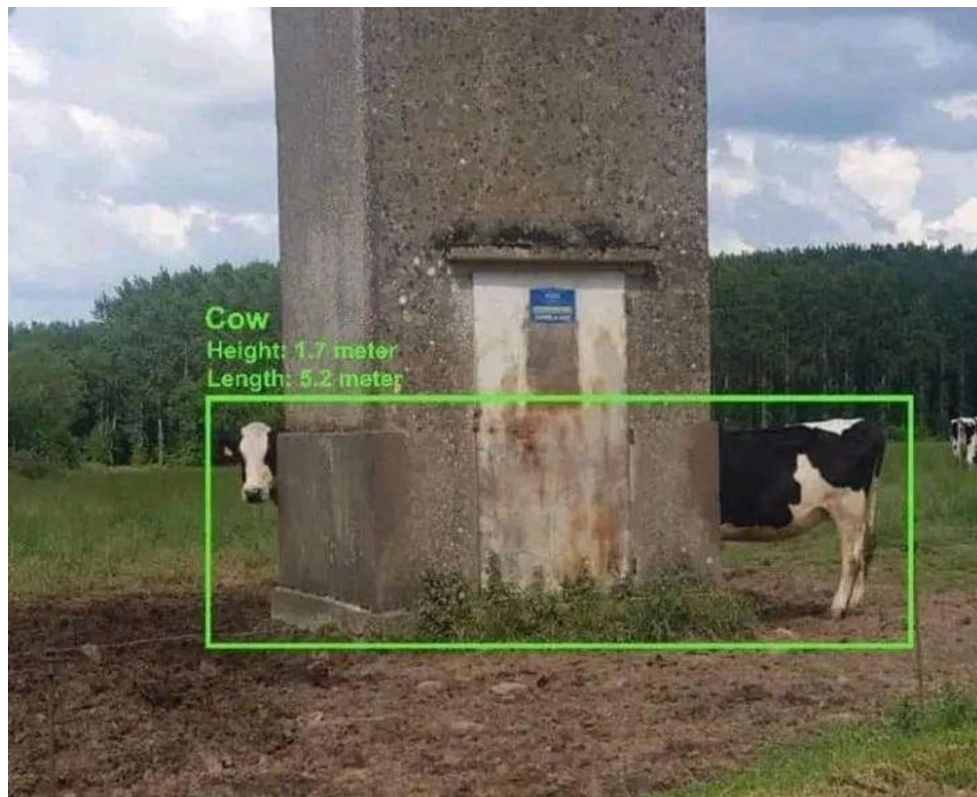
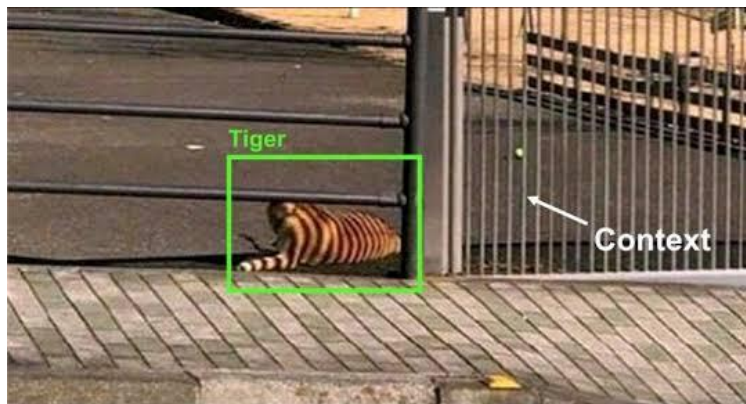
Will AI **replace
My job?**



Challenges (Examples)

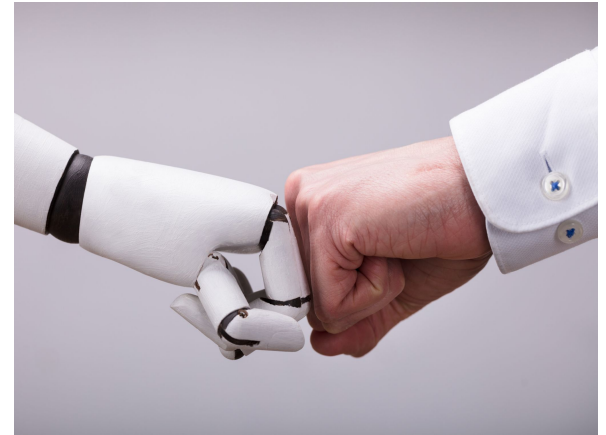
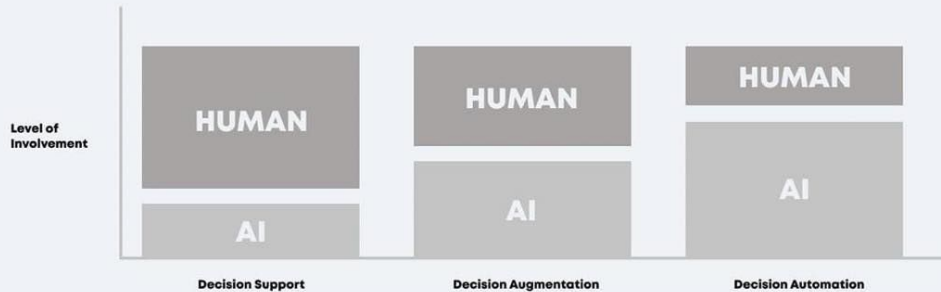


Challenges (Examples)



AI can assist in healthcare setting

How humans and **artificial intelligence** collaborate in decision-making



Thank You

