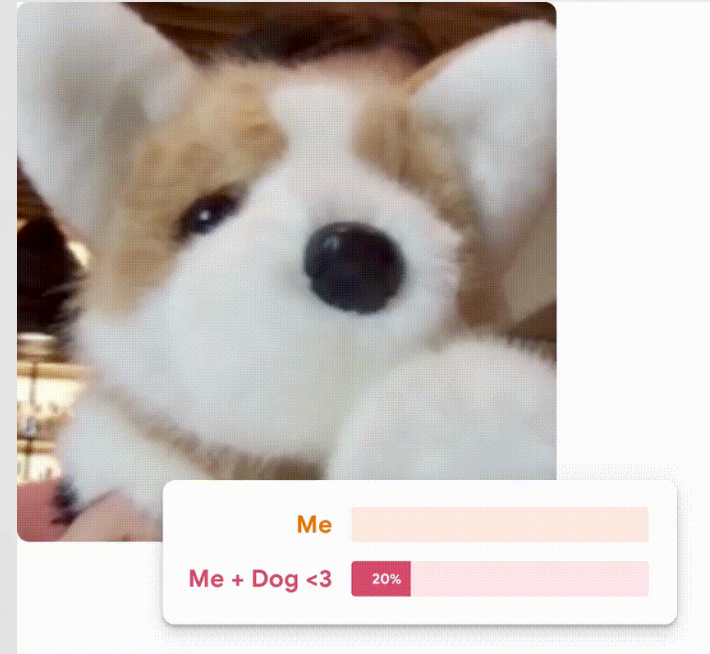


# Teachable Machine

# Teachable Machine

## What is Teachable Machine?

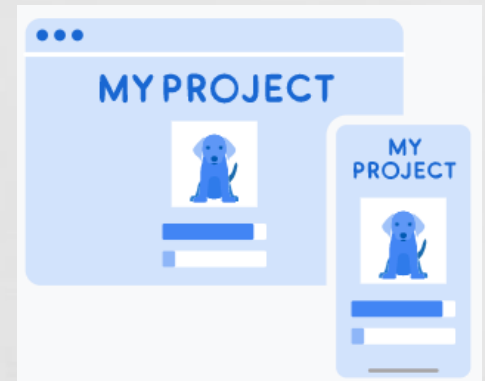
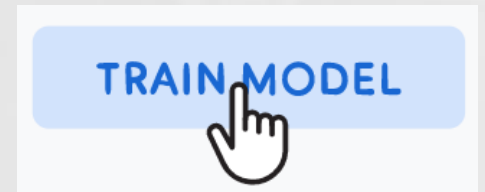
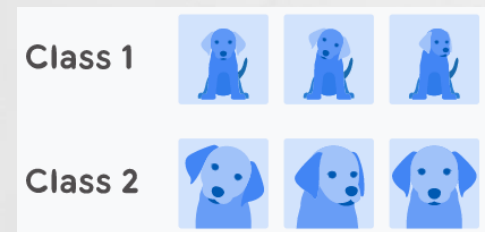
- <https://teachablemachine.withgoogle.com>
  - 웹 기반 인공지능 툴(Web\_Based AI Tool)
  - Image, Sound, Pose 데이터 활용
  - 빠르고 쉽게 머신러닝 모델 생성 가능
  - 복잡한 데이터 전처리나 코딩 과정없이 모델링
  - 생성된 모델 Preview 및 저장하여 Application으로 구성 가능
  - TensorFlow.js, h5, Android, Coral : 모바일 웹 서비스 적용



# Teachable Machine

## How do I use it?

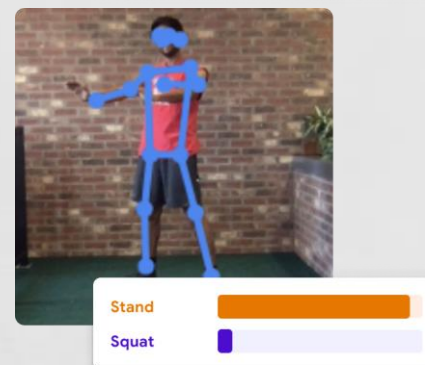
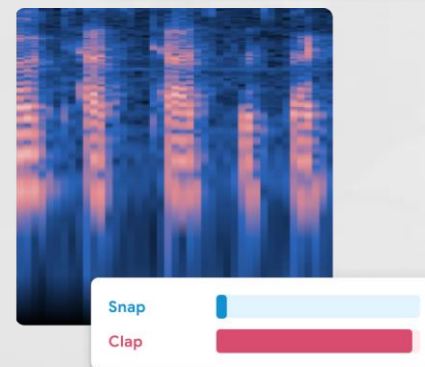
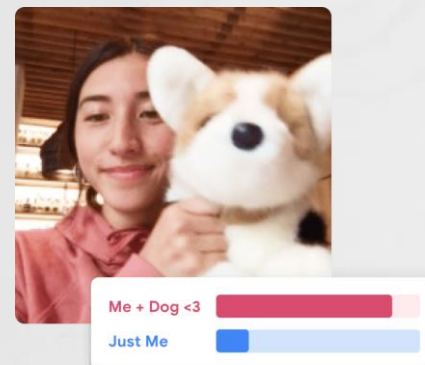
- 자료수집(Gather) -> 모델훈련(Train) -> 모델활용(Export)의 3단계로 구성
- 자료수집(Gather)
  - 훈련을 위한 이미지, 소리, 포즈 데이터 수집
- 모델훈련(Train)
  - 수집된 자료로 머신러닝 모델 생성
- 모델활용(Export)
  - 생성된 모델 검토 및 활용



# Teachable Machine

## Type of Training

- Binary Classification & Categorical Classification
- Image Classification
  - 이미지 데이터 학습 후 분류
- Sound Classification
  - 오디오 데이터 학습 후 분류
- Pose Classification
  - 자세 데이터 학습 후 분류

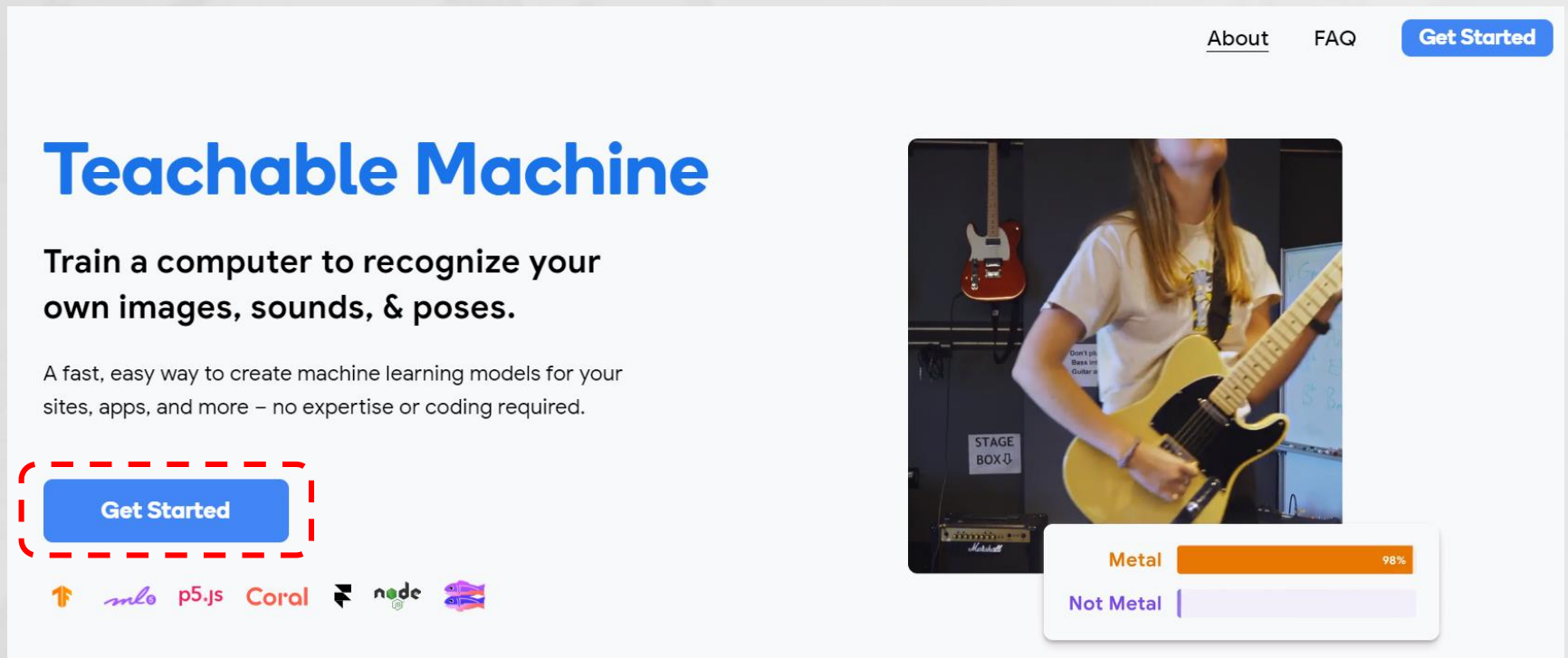


## Image Classification

# Teachable Machine

## Image Classification 1/15

- o <https://teachablemachine.withgoogle.com>
  - Get Started



The screenshot shows the Teachable Machine website. At the top right, there are links for 'About' and 'FAQ', and a blue 'Get Started' button. The main heading is 'Teachable Machine' in large blue letters. Below it, the text reads: 'Train a computer to recognize your own images, sounds, & poses.' and 'A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.' A blue 'Get Started' button is highlighted with a red dashed border. At the bottom, there are logos for various integrations: TensorFlow.js, ml5.js, p5.js, Coral, Node.js, and a fish logo. On the right side, there is a photo of a person playing a yellow electric guitar. Below the photo, a classification result is shown: 'Metal' with a 98% confidence score (indicated by an orange bar) and 'Not Metal' with a lower confidence score (indicated by a purple bar).

About FAQ **Get Started**

# 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**

↑ ml5 p5.js Coral node


**Metal** 98%  
**Not Metal**


# Teachable Machine

## Image Classification 2/15

- New Project
  - Image Project

### New Project

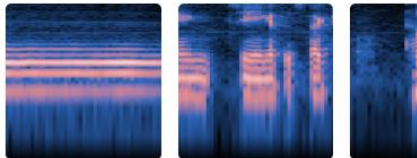
 Open an existing project from Drive.

 Open an existing project from a file.



#### Image Project

Teach based on images, from files or your webcam.



#### Audio Project

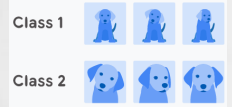
Teach based on one-second-long sounds, from files or your microphone.



#### Pose Project

Teach based on images, from files or your webcam.

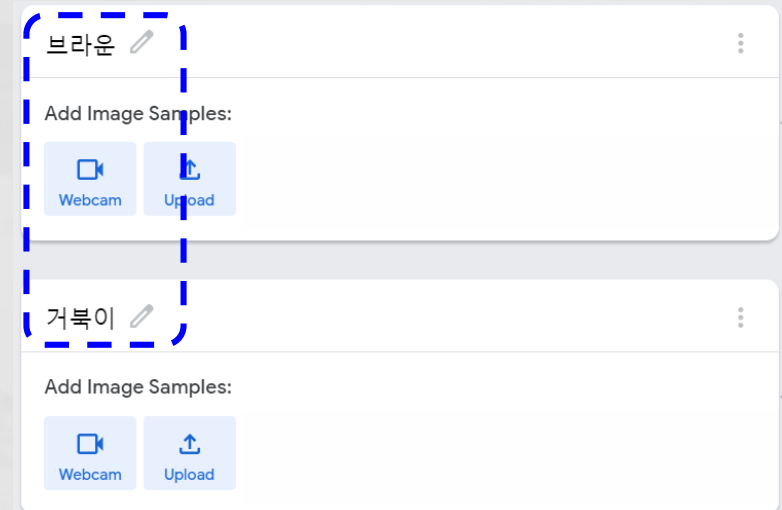
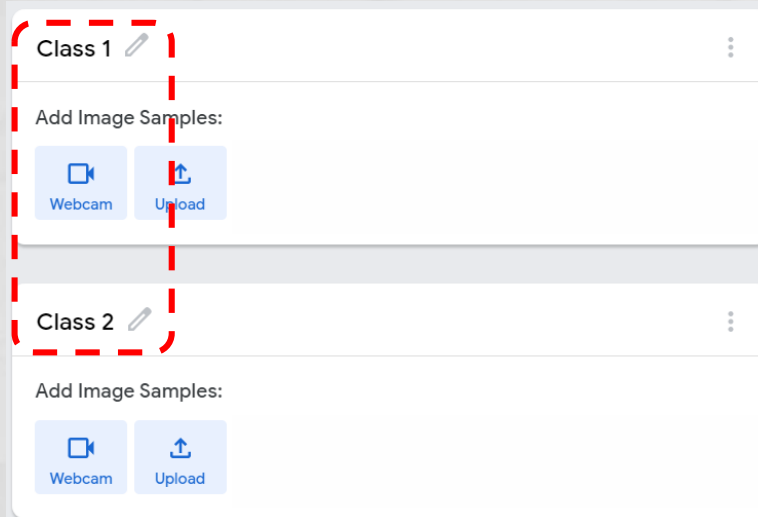
# Teachable Machine



## Image Classification 3/15

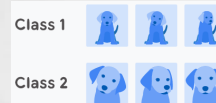
### ○ 자료수집(Gather) - Class 이름 설정

- Class1 -> 브라운
- Class2 -> 거북이



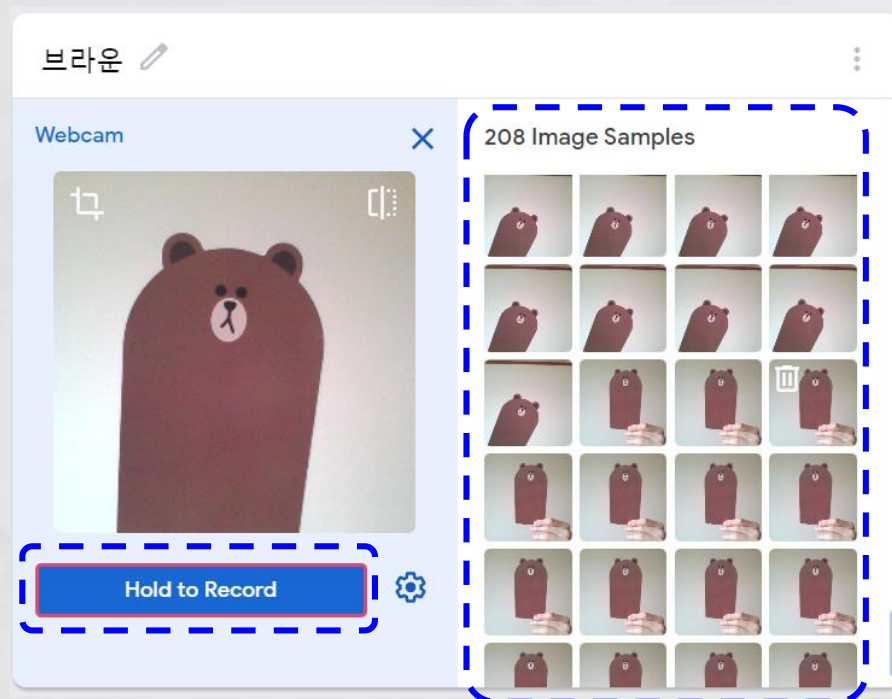
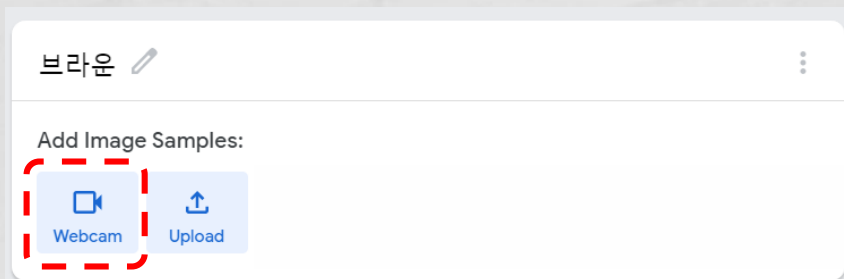


# Teachable Machine

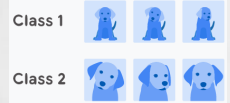


## Image Classification 4/15

- 자료수집(Gather) - 브라운 이미지 웹캠으로 수집
  - Webcam 선택
  - Image Samples 수집
  - 200개 이상 Image Sample 수집

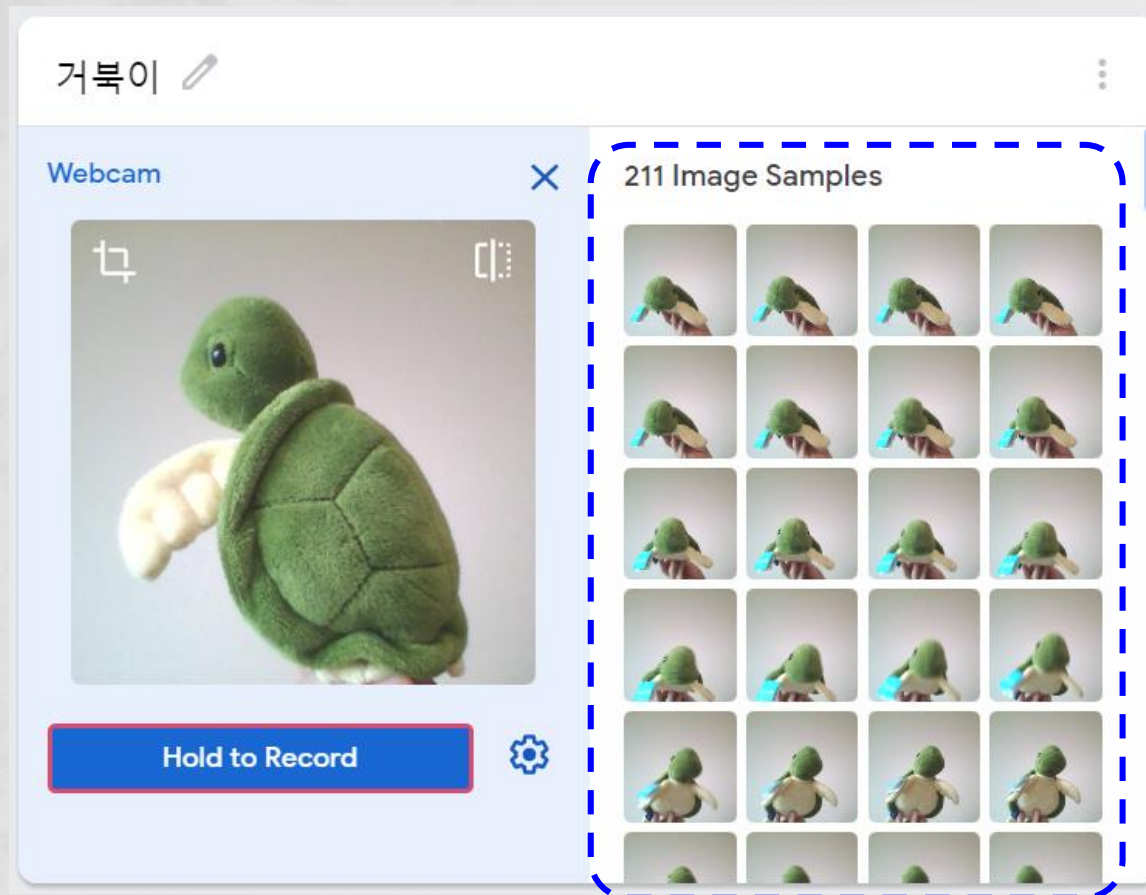


# Teachable Machine



## Image Classification 5/15

- 자료수집(Gather) - 거북이 이미지 웹캠으로 수집



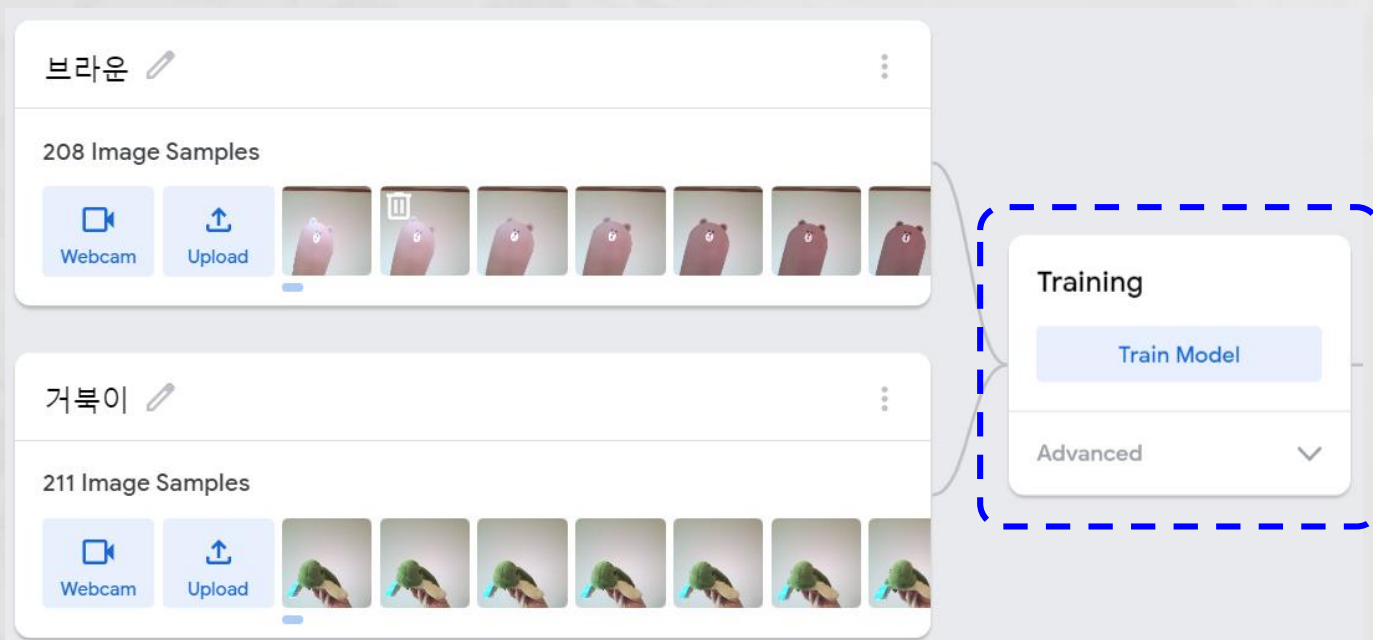
# Teachable Machine

TRAIN MODEL

## Image Classification 6/15

### 모델 훈련(Train)

- Training -> Train Model 선택
- Advanced -> 훈련 옵션 변경



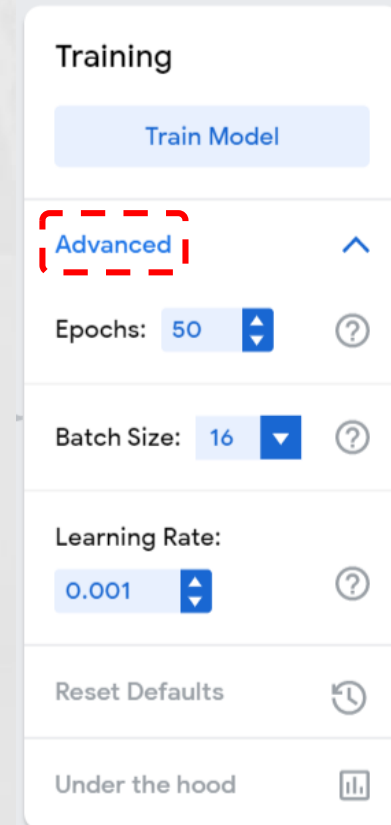
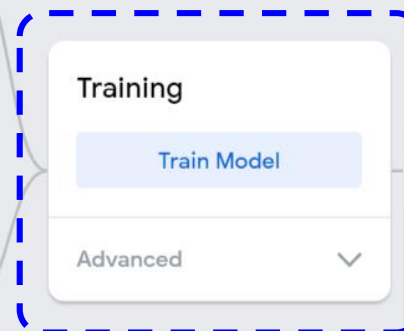
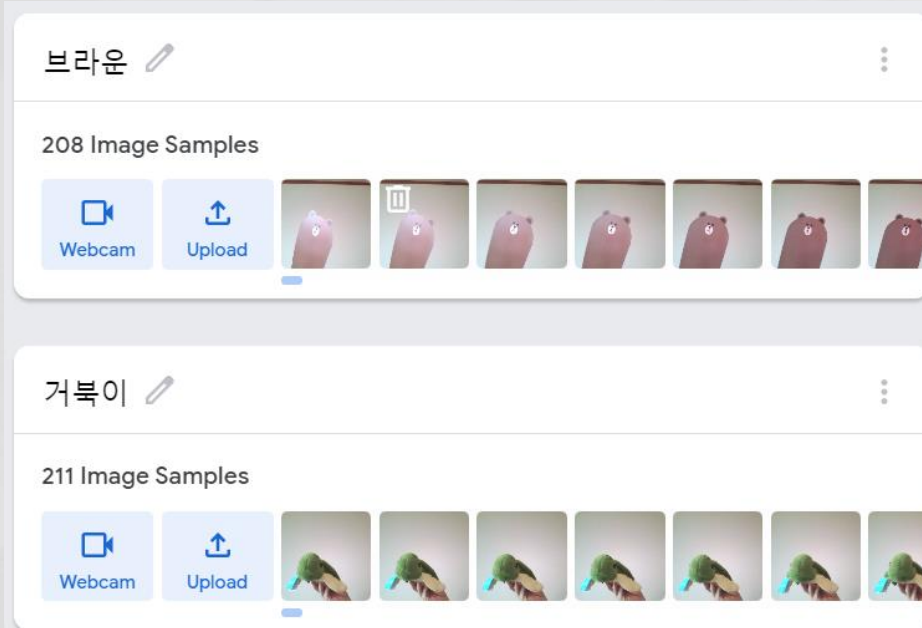
# Teachable Machine

TRAIN MODEL

## Image Classification 7/15

### 모델 훈련 (Train)

- Training -> Train Model 선택
- Advanced -> 훈련 옵션 변경



# Teachable Machine

TRAIN MODEL

## Image Classification 8/15

### 모델 훈련(Train) - 결과 확인

Training

Training...

00:15 - 29 / 50

Advanced

Epochs: 50

Batch Size: 16

Learning Rate: 0.001

Reset Defaults

Under the hood

Training

Model Trained

Advanced

Epochs: 50

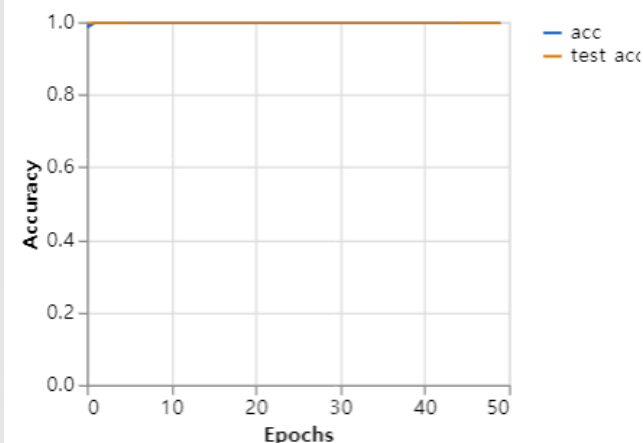
Batch Size: 16

Learning Rate: 0.001

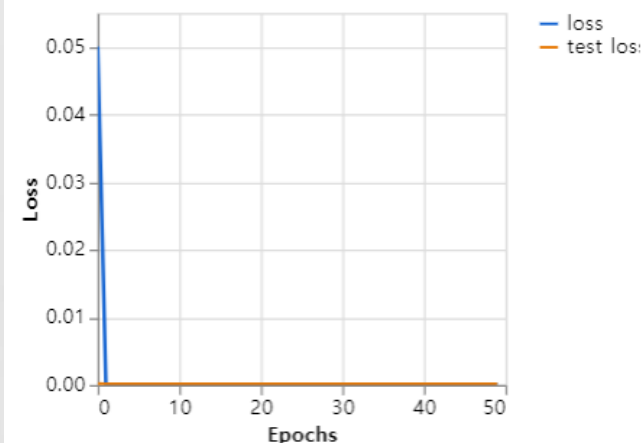
Reset Defaults

Under the hood

Accuracy per epoch



Loss per epoch



# Teachable Machine

TRAIN MODEL

## Image Classification 9/15

### 모델 훈련(Train) - 결과 확인

The screenshot displays the Teachable Machine interface. On the left, the 'Training' section is highlighted with a blue dashed border. It includes a 'Model Trained' button and an 'Advanced' settings panel. The 'Advanced' panel shows 'Epochs' set to 50, 'Batch Size' set to 16, and 'Learning Rate' set to 0.001. Below these are 'Reset Defaults' and 'Under the hood' options. On the right, the 'Preview' section shows a live video feed of a green stuffed turtle. Below the video, the 'Output' section is highlighted with a red dashed border. It displays two categories: '브라운' (Brown) with a light orange bar and '거북이' (Turtle) with a dark red bar at 100%.

Training

Model Trained

Advanced

Epochs: 50

Batch Size: 16

Learning Rate: 0.001

Reset Defaults

Under the hood

Preview

Export Model

Input: ON Webcam

Output

브라운

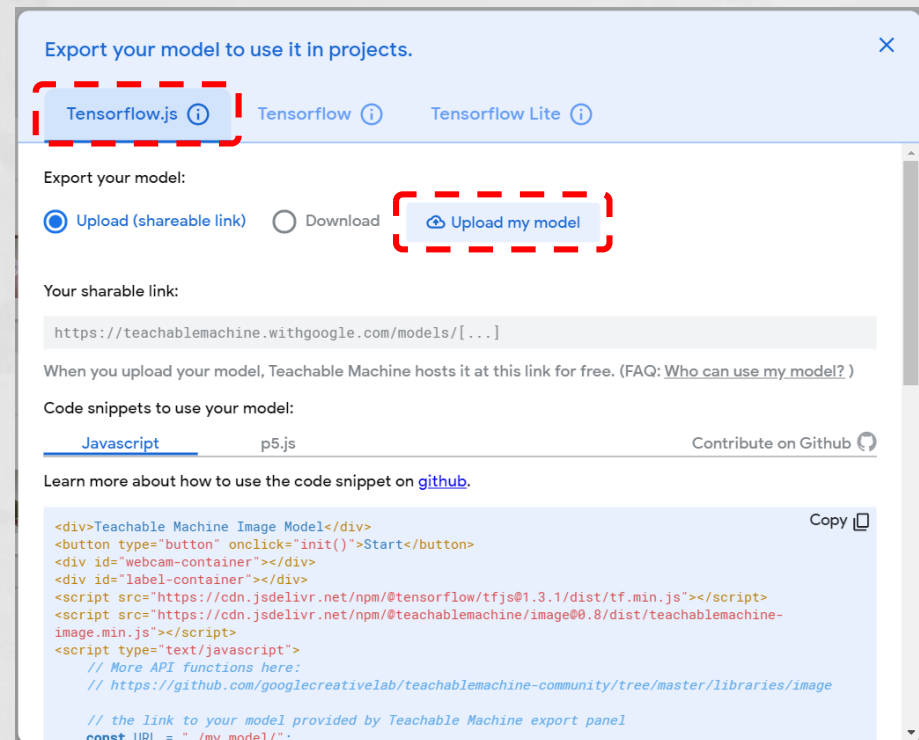
거북이 100%

# Teachable Machine

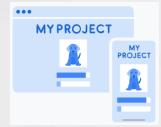


## Image Classification 10/15

- 모델 활용(Export) - 스마트폰
  - Export Model -> Tensorflow.js -> Upload my model



# Teachable Machine



## Image Classification 11/15

### 모델 활용(Export) - 스마트폰

- 스마트폰 브라우저 -> Your sharable link

Export your model to use it in projects. ✕

Tensorflow.js ⓘ Tensorflow ⓘ Tensorflow Lite ⓘ

Export your model:

☒ Upload (shareable link) ☐ Download Uploading...

Your sharable link:

[https://teachablemachine.withgoogle.com/models/\[...\]](https://teachablemachine.withgoogle.com/models/[...])

When you upload your model, Teachable Machine hosts it at this link for free. (FAQ: [Who can use my model?](#))

Uploading your model...

Code snippets to use your model:

JavaScript p5.js [Contribute on Github](#)

Learn more about how to use the code snippet on [github](#).

```
<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@1.3.1/dist/tf.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/@teachablemachine/image@0.8/dist/teachablemachine-image.min.js"></script>
<script type="text/javascript">
  // More API functions here:
```

Export your model to use it in projects. ✕

Tensorflow.js ⓘ Tensorflow ⓘ Tensorflow Lite ⓘ

Export your model:

☒ Upload (shareable link) ☐ Download Update my cloud model

Your sharable link:

[https://teachablemachine.withgoogle.com/models/pzlsy\\_qu/](https://teachablemachine.withgoogle.com/models/pzlsy_qu/) Copy

When you upload your model, Teachable Machine hosts it at this link for free. (FAQ: [Who can use my model?](#))

✓ Your cloud model is up to date.

Code snippets to use your model:

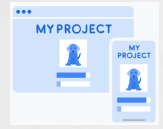
JavaScript p5.js [Contribute on Github](#)

Learn more about how to use the code snippet on [github](#).

```
<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@1.3.1/dist/tf.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/@teachablemachine/image@0.8/dist/teachablemachine-image.min.js"></script>
<script type="text/javascript">
  // More API functions here:
```



# Teachable Machine



## Image Classification 12/15

- 모델 활용(Export) - 웹페이지
  - Code snippets to use your model: -> Javascript -> Copy

Export your model to use it in projects. ✕

Tensorflow.js ⓘ TensorFlow ⓘ TensorFlow Lite ⓘ

Export your model:

☒ Upload (shareable link) ☐ Download

Your sharable link:

[https://teachablemachine.withgoogle.com/models/pzlsy\\_qu/](https://teachablemachine.withgoogle.com/models/pzlsy_qu/) Copy

When you upload your model, Teachable Machine hosts it at this link for free. (FAQ: [Who can use my model?](#))

✓ Your cloud model is up to date.

Code snippets to use your model:

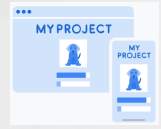
Javascript p5.js [Contribute on Github](#)

Learn more about how to use the code snippet on [github](#).

```
<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@1.3.1/dist/tf.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/@teachablemachine/image@0.8/dist/teachablemachine-image.min.js"></script>
<script type="text/javascript">
  // More API functions here:
```

Copy

# Teachable Machine



## Image Classification 13/15

### 모델 활용(Export) - 웹페이지

- 복사 된 Javascript 코드 -> notepad -> 새문서에 붙여넣기

```
제목 없음 - 메모장

<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@1.3.1/dist/tf.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/@teachablemachine/image@0.8/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 = "https://teachablemachine.withgoogle.com/models/pzlsy_qu/";

  let model, webcam, labelContainer, maxPredictions;

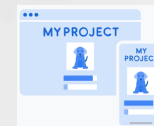
  // Load the image model and setup the webcam
  async function init() {
    const modelURL = URL + "model.json";
    const metadataURL = URL + "metadata.json";

    // 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"));
    }
  }
  init();
  function loop() {
    const prediction = model.classifyImage(webcam.canvas).classes;
    // ... (rest of the loop logic)
  }
  window.requestAnimationFrame(loop);
}
```

# Teachable Machine



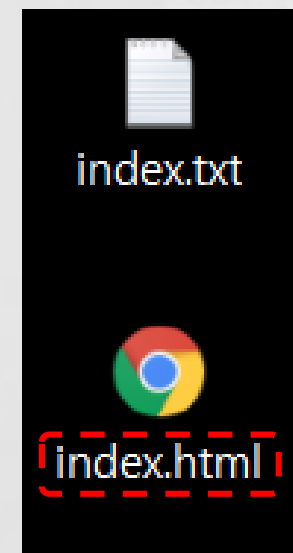
## Image Classification 14/15

### 모델 활용(Export) - 웹페이지

- HTML 해더 추가 -> index.txt 저장 -> index.html 확장자 변경

```
제목 없음
파일(F) 편집(E) 서식(O) 보기(V) 도움말(H)
<html>
<body>
  <div>Teachable Machine Image Model</div>
  <button type="button" onclick="init()">Start</button>
```

```
  }
</script>
</body>
</html>
```



# Teachable Machine



## Image Classification 15/15

- 모델 활용(Export) - 웹페이지
  - index.html 실행



# Teachable Machine

## Sound & Pose Classification

- Image Classification과 같은 방식으로 진행

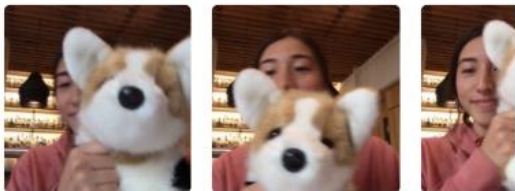
### New Project



Open an existing project from Drive.

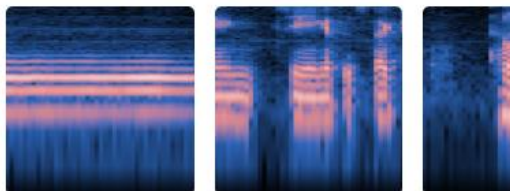


Open an existing project from a file.



#### Image Project

Teach based on images, from files or your webcam.



#### Audio Project

Teach based on one-second-long sounds, from files or your microphone.



#### Pose Project

Teach based on images, from files or your webcam.