

# Google Teachable Machine을 이용한 AI 서비스 만들기

동의과학대학교 인공지능컴퓨터정보과  
김 종 현 교수

# Teachable Machine 이란?

- 웹 기반 도구로 누구나 쉽고 빠르게 AI 학습 모델을 만들 수 있음.
  - 데이터를 학습 시켜서 이미지(Image), 사운드(Sound), 자세(Pose) 추론.
  - 비전문가들도 학습 모델을 이용하여 쉽게 AI 서비스(웹/ 앱)를 만들 수 있음.
  - Arduino, Microbit 등과 연동하여 AI + 사물인터넷(IoT) 서비스 제작 가능
- 
- YouTube 동영상 : Making AI easier for everyone
    - Teachable Machine 2.0 : <https://youtu.be/T2qQGqZxkD0>

# AI 서비스 제작 과정

- 데이터 수집(Dataset)
- 데이터 업로드(Upload)
- 데이터 학습(Train)하여 모델 만들기
- 모델 내보내기(Export)
- AI 서비스 만들기(Service)

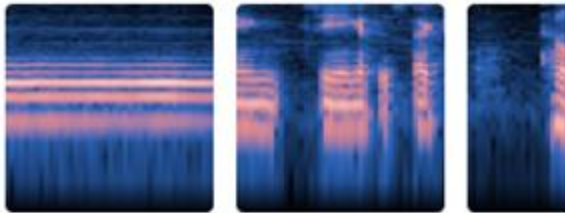
# AI 프로젝트

- 이미지 추론
- 오디오(Sound) 추론
- 자세(Pose) 추론



## 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.

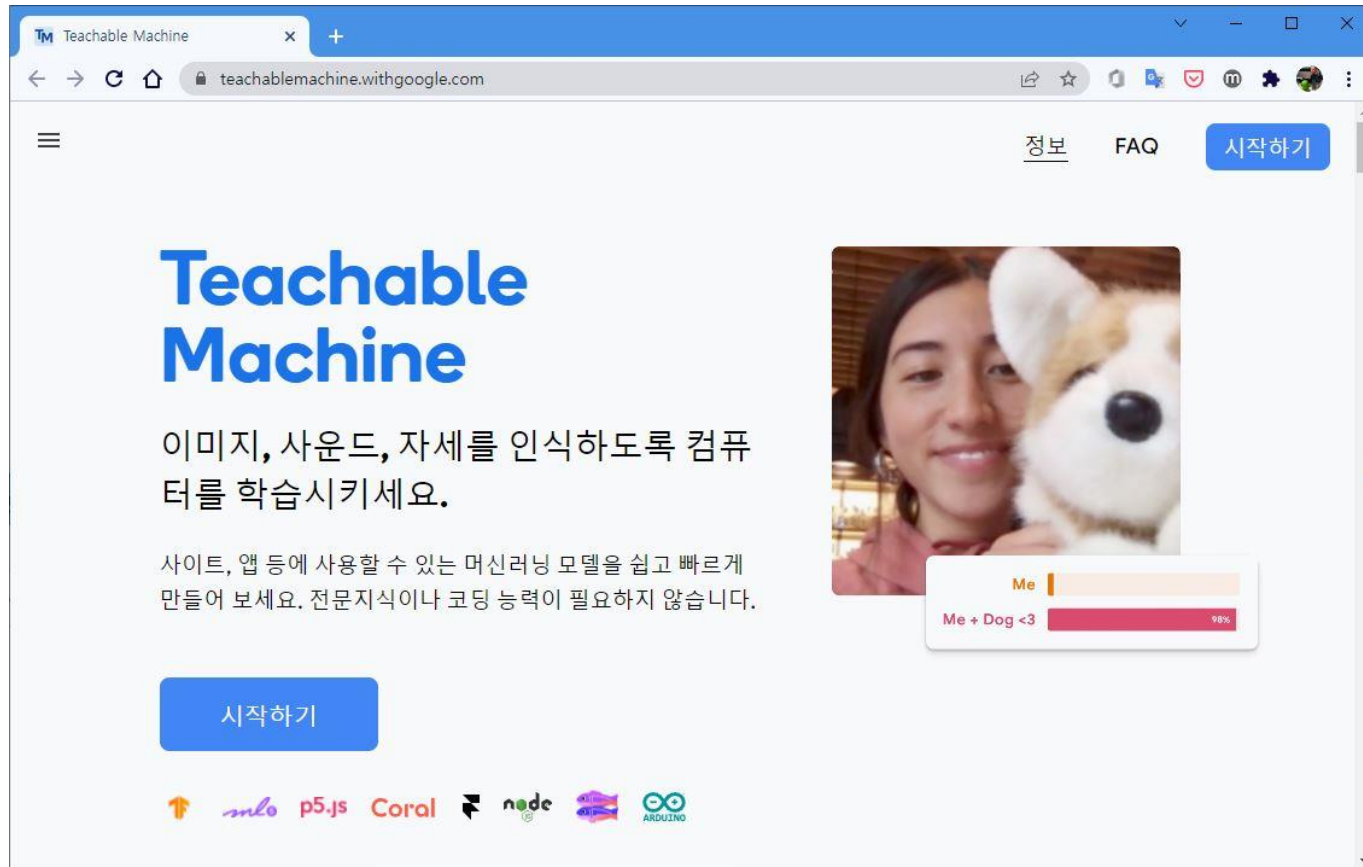


## Pose Project

Teach based on images, from files or your webcam.

# Teachable Machine 시작하기

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



# 실습 01 : Thumb-up, Thumb-down 이미지 추론



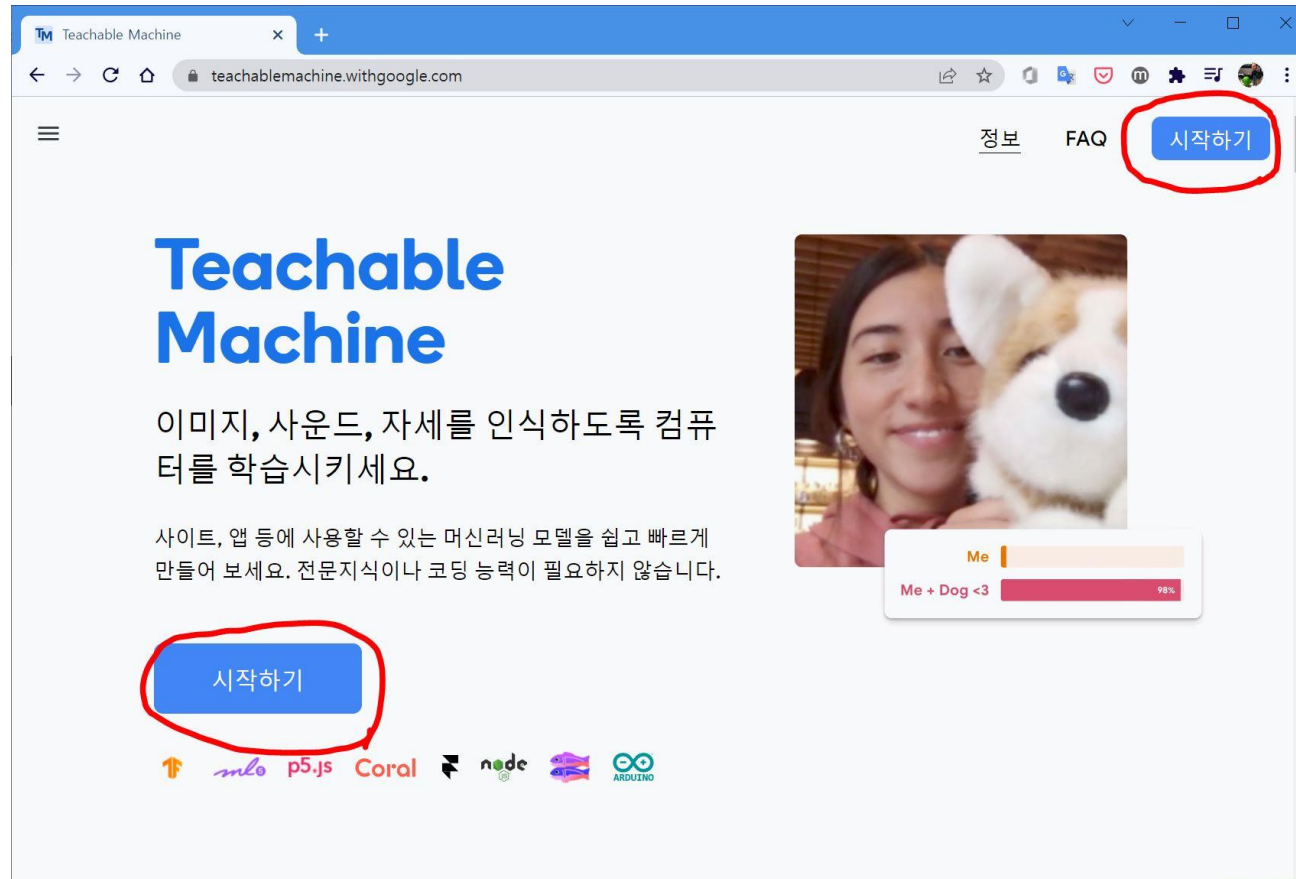
# 준비물

- 웹 캠이 부착되어 있는 노트북 혹은 PC
- 인터넷 연결
- 웹 브라우저 : 구글 크롬



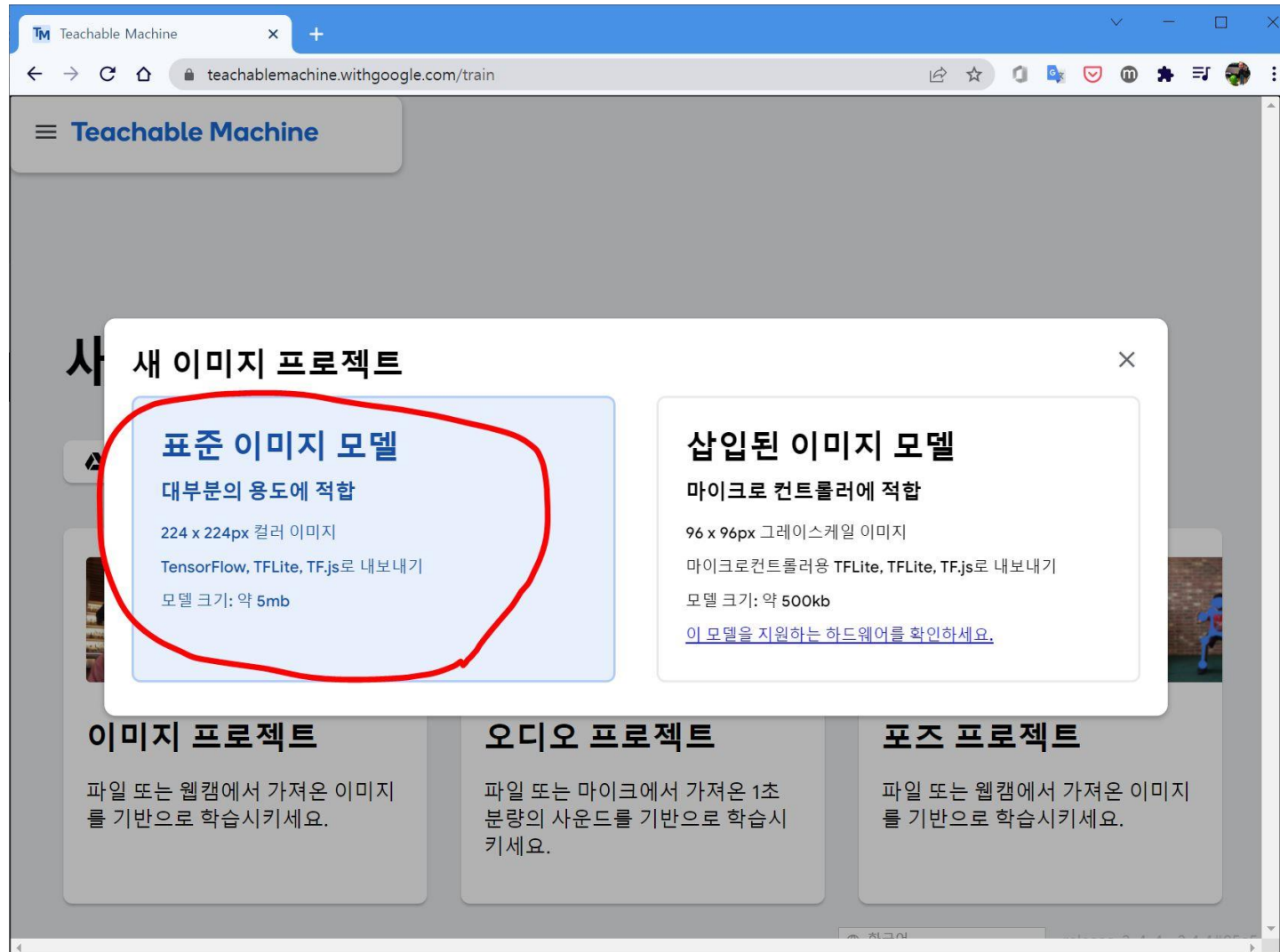
# 시작하기

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

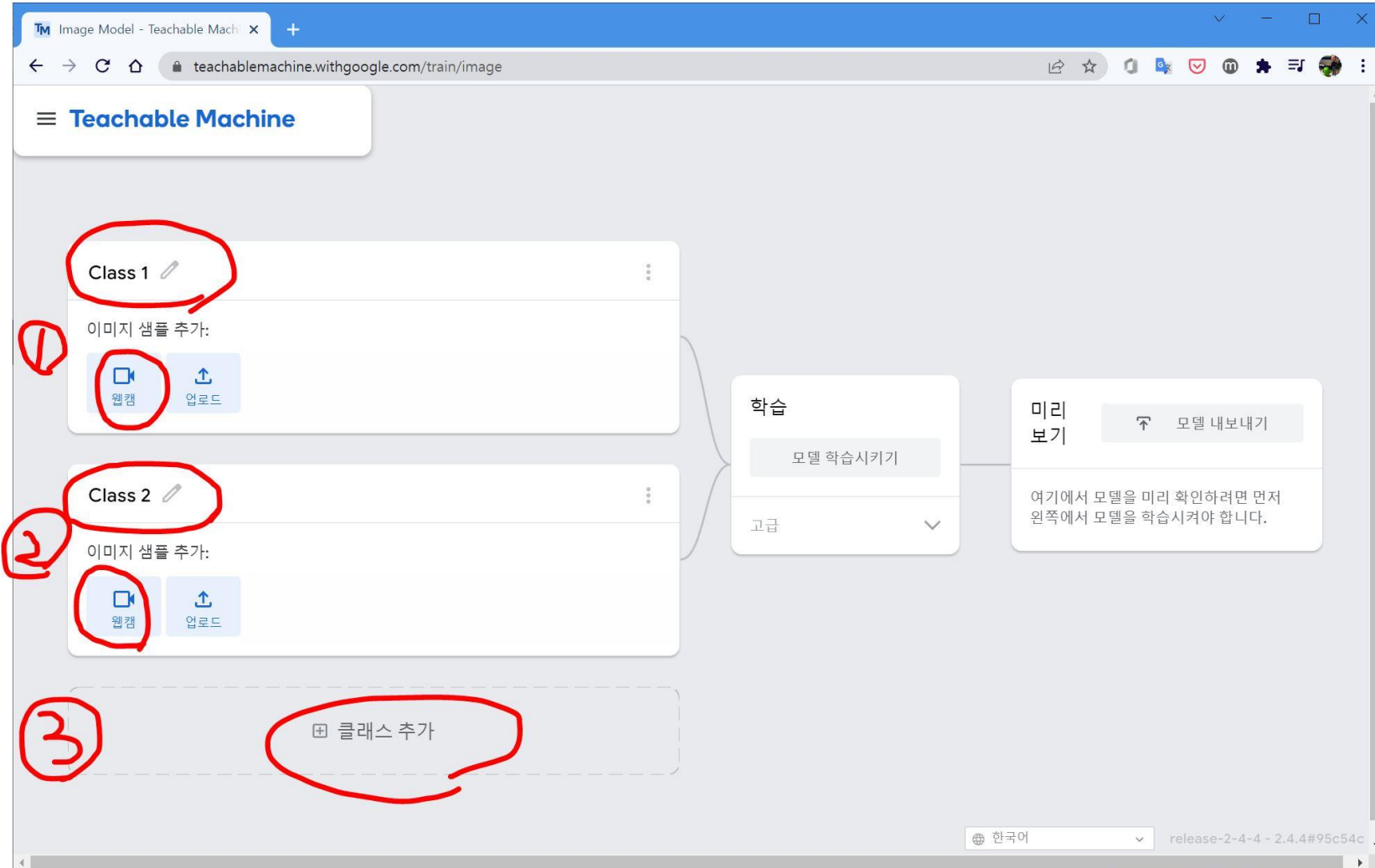




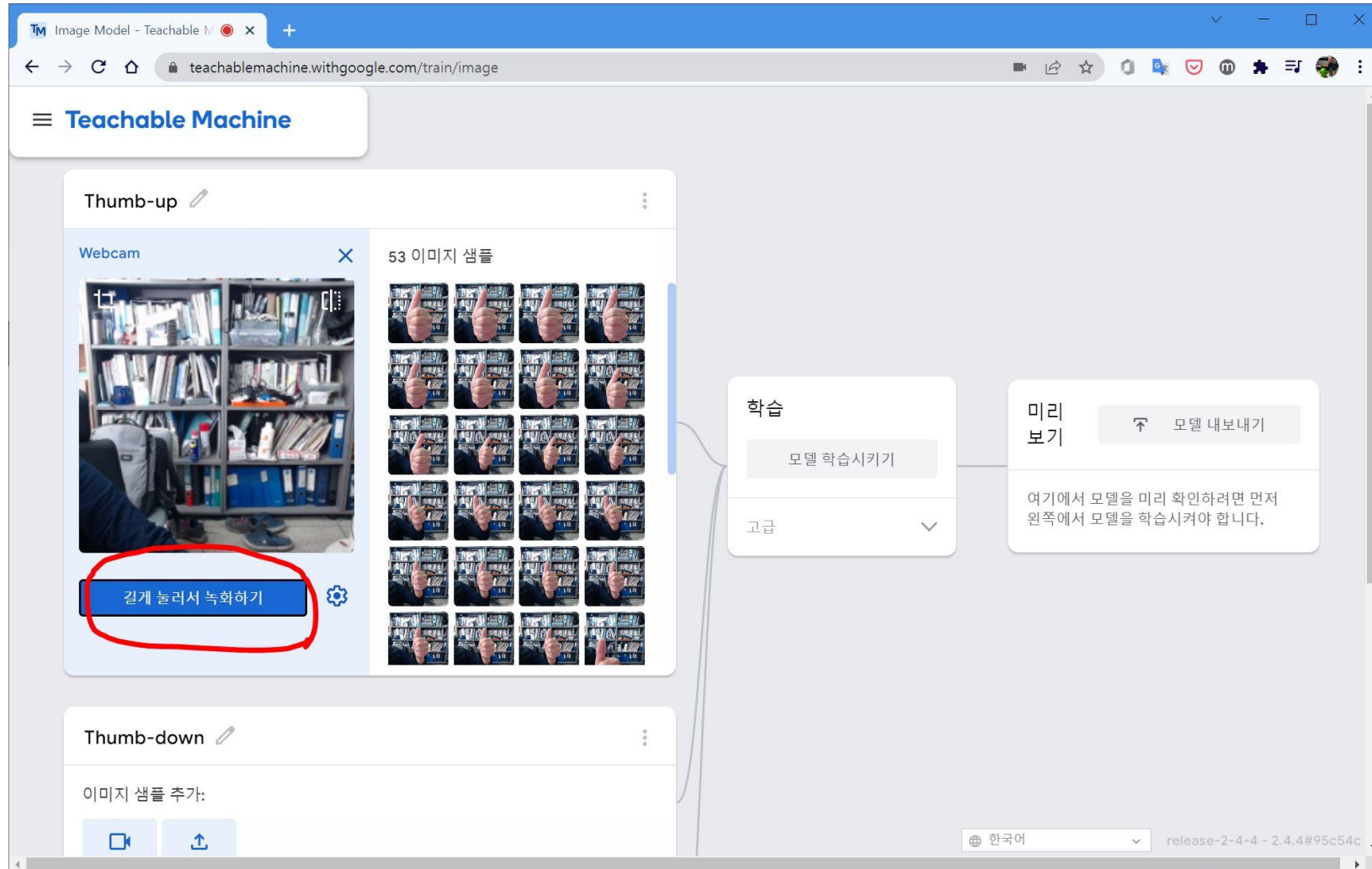
# 데이터 수집 : webcam



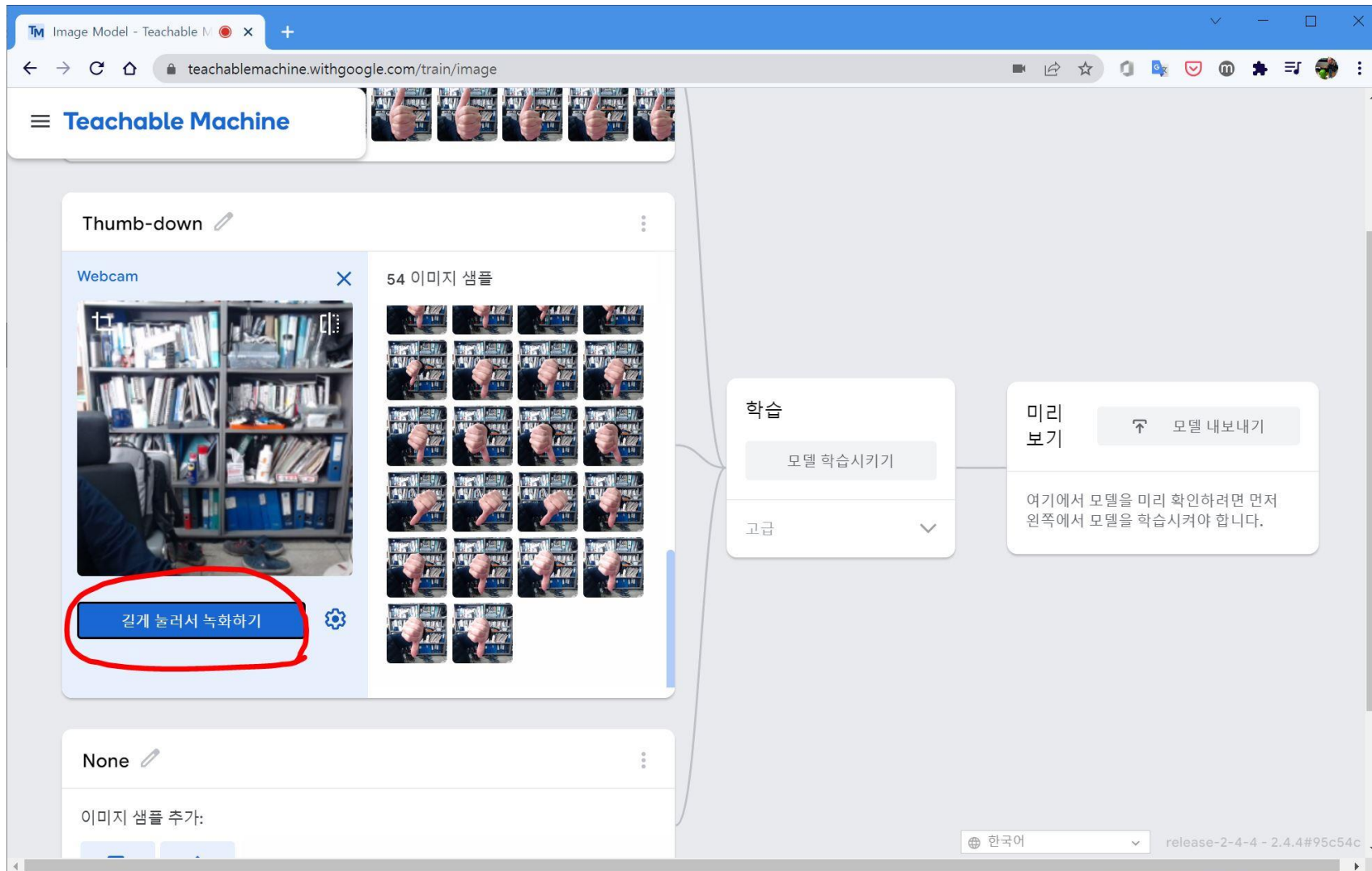
# label(class) 만들기



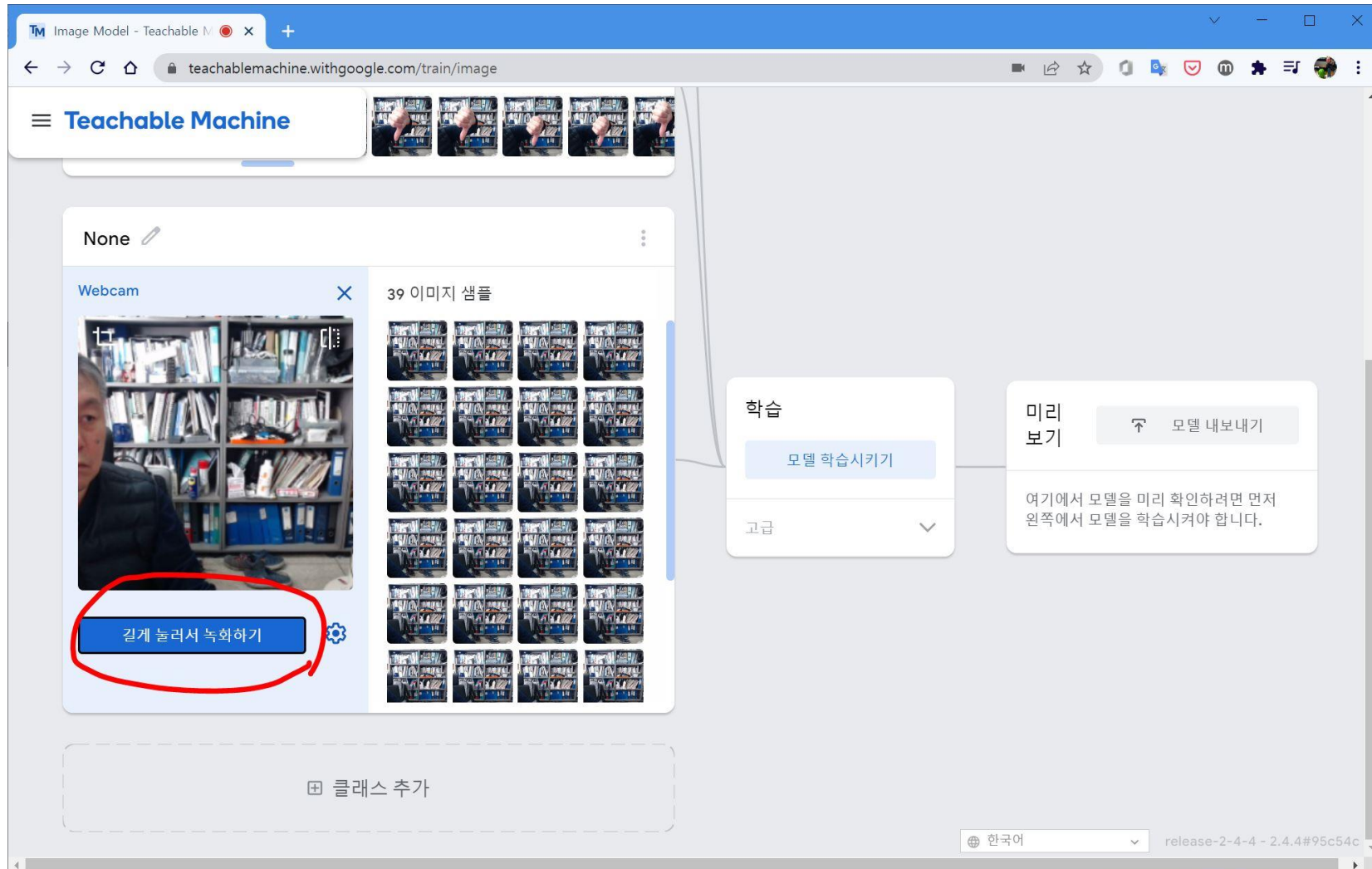
# Thumb-up 데이터 수집



# Thumb-down 데이터 수집



# None 데이터 수집



# 데이터 학습

The screenshot shows the Teachable Machine web interface for training an image model. The browser address bar displays `teachablemachine.withgoogle.com/train/image`. The interface is divided into several sections:

- Teachable Machine Header:** Includes a menu icon and the text "Teachable Machine".
- Image Samples:** Three sections are visible, each with a "웹캠" (Webcam) button, an "업로드" (Upload) button, and a row of image thumbnails. The first section is labeled "53 이미지 샘플", the second "54 이미지 샘플", and the third "39 이미지 샘플".
- Thumb-down:** A section with a pencil icon for editing.
- None:** A section with a pencil icon for editing.
- Training Panel (Right):** Contains a "학습" (Train) button, a progress bar showing "00:06 - 43 / 50", and various settings: "고급" (Advanced), "에포크: 50", "배치 크기: 16", "학습률: 0.001", "기본값 초기화" (Reset Defaults), and "고급 설정" (Advanced Settings).
- Pre-view Panel (Far Right):** Includes a "미리 보기" (Preview) button, a "모델 내보내기" (Export Model) button, and a note: "여기에서 모델을 미리 확인하려면 먼저 왼쪽에서 모델을 학습시켜야 합니다." (To preview the model here, you must first train the model on the left).

A red circle highlights the "학습" (Train) button and the progress bar in the training panel. A tooltip message is also visible: "탭을 전환하지 마세요. 모델을 학습시키려면 이 탭이 열려 있어야 합니다." (Do not switch tabs. This tab must be open to train the model.)



# 미리보기 : Thumb-up

The screenshot displays the Teachable Machine web interface for training an image model. The left sidebar shows three classes: '53 이미지 샘플' (53 image samples) with a 'Thumb-up' label, 'Thumb-down' (4 images), and 'None' (39 images). The main area shows training progress: '모델 학습 완료됨' (Model training completed). The right sidebar shows the '미리보기' (Preview) section with a 'Webcam' input and a '출력' (Output) section. The '출력' section shows three classes: 'Thum... up' with a 98% confidence score, 'Thum... down' with a 0% score, and 'None' with a 0% score. A red circle highlights the 'Thum... up' output bar.

Teachable Machine

53 이미지 샘플

웹캠 업로드

Thumb-down

54 이미지 샘플

웹캠 업로드

None

39 이미지 샘플

웹캠 업로드

클래스 추가

학습

모델 학습 완료됨

고급

에포크: 50

배치 크기: 16

학습률: 0.001

기본값 초기화

고급 설정

미리보기

모델 내보내기

입력 사용 Webcam

출력

Thum... up 98%

Thum... down

None

한국어 release-2-4-4 - 2.4.4#95c54c

# 미리보기 : Thumb-down

The screenshot shows the Teachable Machine web interface. On the left, there are three class selection panels: '53 이미지 샘플' (53 image samples) with a '웹캠' (Webcam) button, 'Thumb-down' (54 image samples) with a '웹캠' button, and 'None' (39 image samples) with a '웹캠' button. A red bracket highlights the 'Thumb-down' panel. In the center, there is a '학습' (Train) section with a '모델 학습 완료됨' (Model training completed) message. Below this, there are settings for '고급' (Advanced) mode: '에포크: 50' (Epochs: 50), '배치 크기: 16' (Batch size: 16), '학습률: 0.001' (Learning rate: 0.001), '기본값 초기화' (Reset defaults), and '고급 설정' (Advanced settings). On the right, there is a '미리보기' (Preview) section. It shows a '모델 내보내기' (Export model) button, an '입력' (Input) section with a '사용' (Use) toggle and a 'Webcam' dropdown, and a '출력' (Output) section. The '출력' section shows three bars: 'Thum... up' (orange), 'Thum... down' (red, 98%), and 'None' (purple). A red circle highlights the 'Thum... down' bar.

Teachable Machine

53 이미지 샘플

웹캠 업로드

Thumb-down

54 이미지 샘플

웹캠 업로드

None

39 이미지 샘플

웹캠 업로드

클래스 추가

학습

모델 학습 완료됨

고급

에포크: 50

배치 크기: 16

학습률: 0.001

기본값 초기화

고급 설정

미리보기

모델 내보내기

입력

사용 Webcam

출력

Thum... up

Thum... down 98%

None

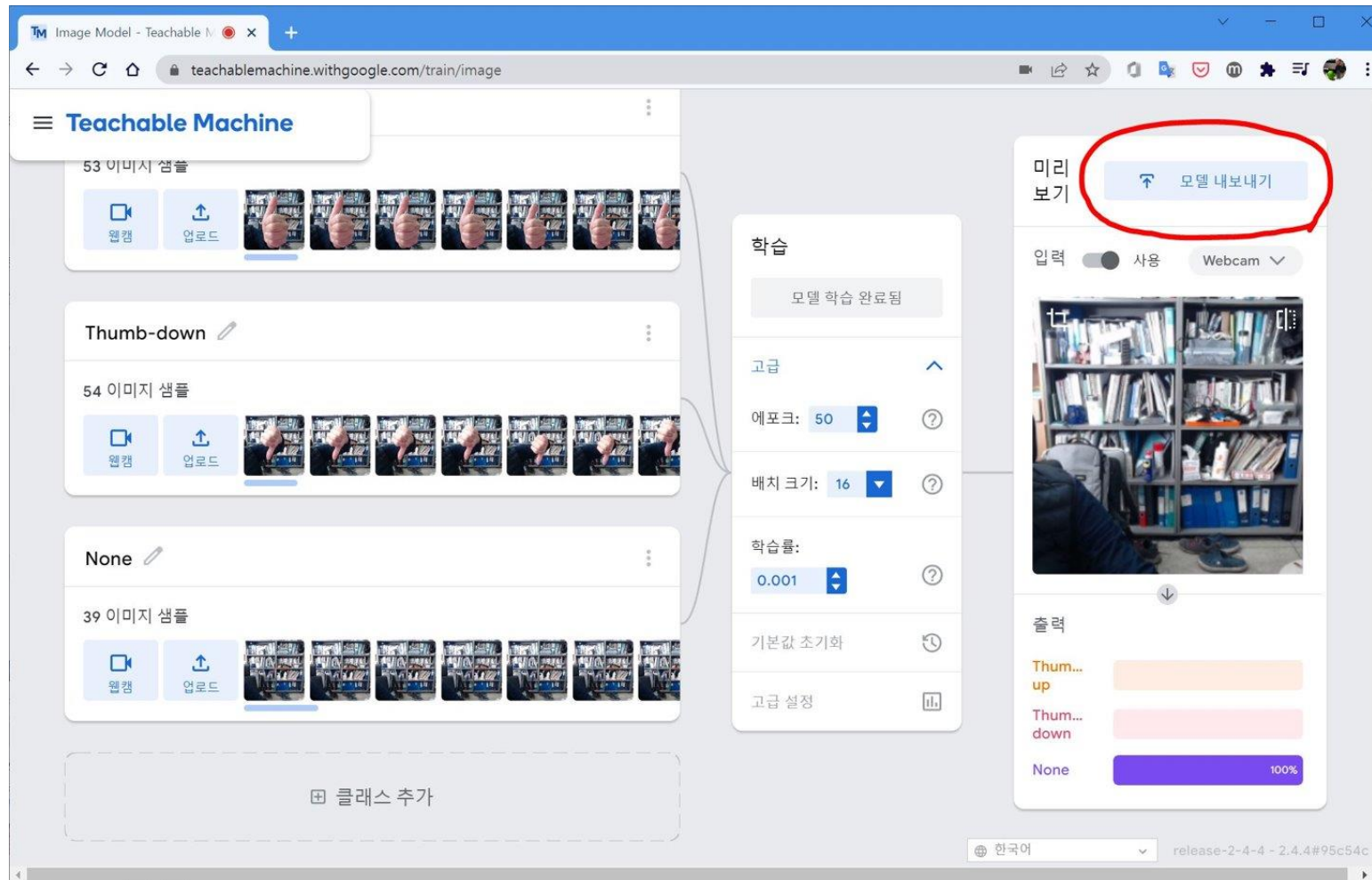
한국어 release-2-4-4 - 2.4.4#95c54c



# 미리보기 : None (background)

The screenshot displays the Teachable Machine web interface. On the left, there are three image sample sections: '53 이미지 샘플' (53 image samples) with a '웹캠' (Webcam) and '업로드' (Upload) button, 'Thumb-down' with a pencil icon, '54 이미지 샘플' (54 image samples) with '웹캠' and '업로드' buttons, and 'None' with a pencil icon and '39 이미지 샘플' (39 image samples) with '웹캠' and '업로드' buttons. A '클래스 추가' (Add Class) button is at the bottom left. In the center, the '학습' (Training) section shows '모델 학습 완료됨' (Model training completed), '고급' (Advanced) settings, '에포크: 50' (Epochs: 50), '배치 크기: 16' (Batch size: 16), '학습률: 0.001' (Learning rate: 0.001), '기본값 초기화' (Reset defaults), and '고급 설정' (Advanced settings). On the right, the '미리보기' (Preview) section shows '모델 내보내기' (Export model), '입력' (Input) with a 'Webcam' dropdown, a preview image of a bookshelf, and the '출력' (Output) section. The '출력' section is circled in red and shows three options: 'Thum... up' (orange bar), 'Thum... down' (pink bar), and 'None' (purple bar with '100%' next to it).

# 학습 모델 배포하기



# 학습 모델 배포하기 : 클라우드 배포

프로젝트에서 모델을 사용하려면 모델을 내보내세요.

Tensorflow.js ⓘ Tensorflow ⓘ Tensorflow Lite ⓘ

모델 내보내기:

☒ 업로드(공유 가능한 링크) ☐ 다운로드

공유 가능한 링크:

<https://teachablemachine.withgoogle.com/models/LiVruZ5wf/> 복사

모델을 업로드하면 Teachable Machine에서 이 링크에 모델을 무료로 호스팅합니다. (FAQ: 내 모델을 사용할 수 있는 사용자는 누구인가요?)

✓ 클라우드 모델이 최신 상태입니다.

모델에서 사용할 코드 스니펫:

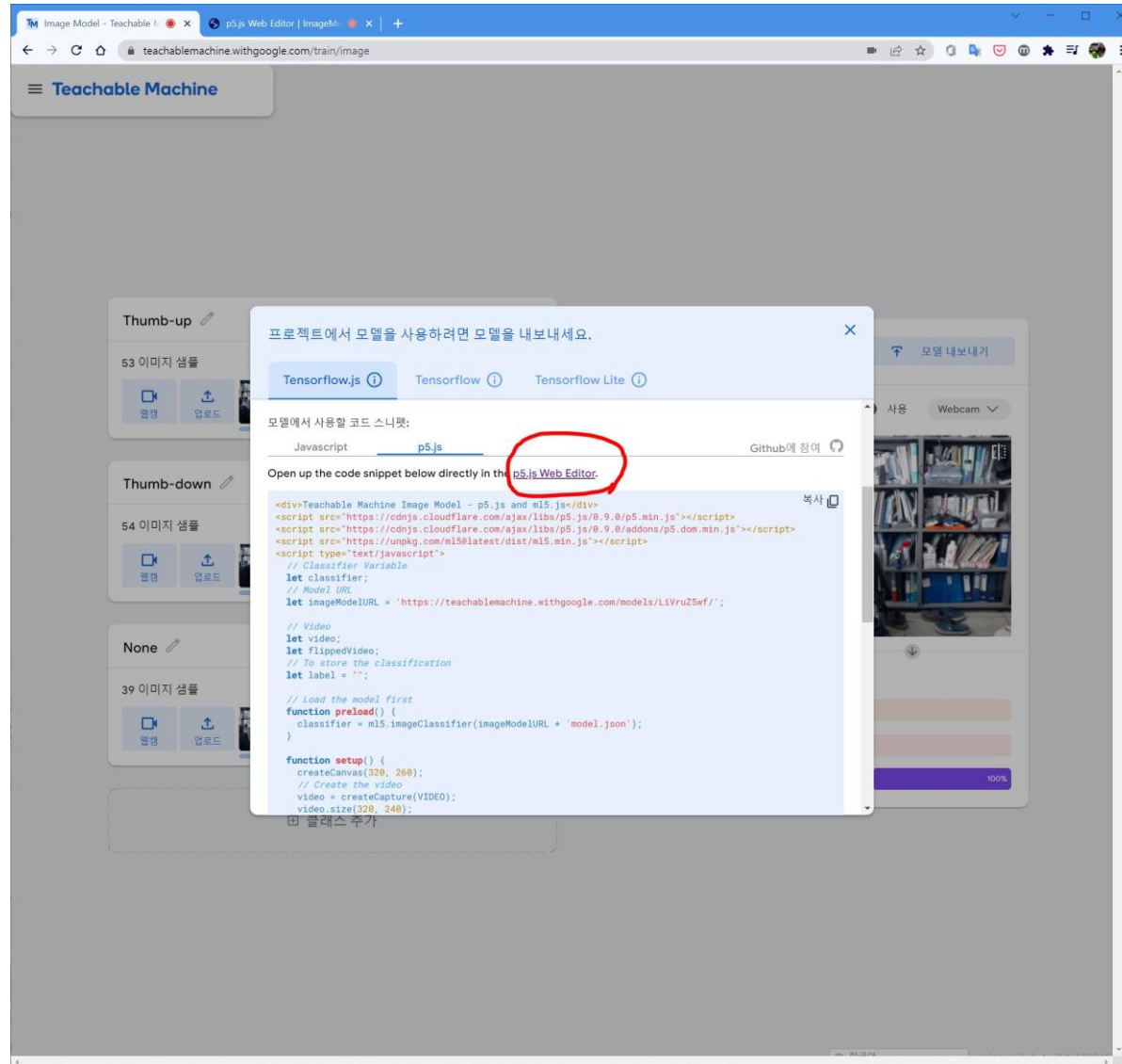
Javascript p5.js Github에 참여

Open up the code snippet below directly in the [p5.js Web Editor](#).

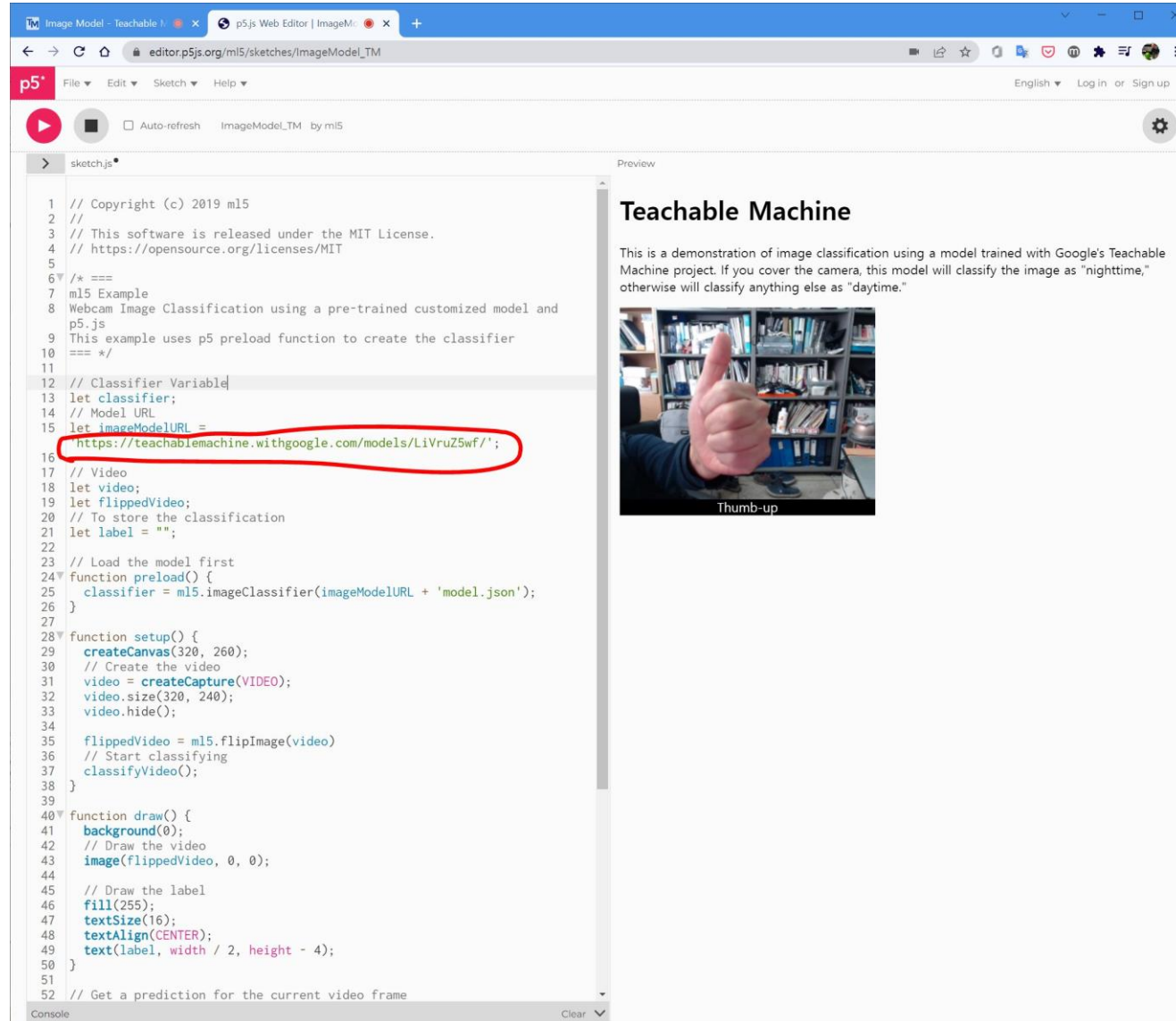
```
<div>Teachable Machine Image Model - p5.js and ml5.js</div>
<script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/0.9.0/p5.min.js"></script>
<script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/0.9.0/addons/p5.dom.min.js"></script>
<script src="https://unpkg.com/ml5@latest/dist/ml5.min.js"></script>
<script type="text/javascript">
  // Classifier Variable
  let classifier;
```

복사

# AI 서비스 만들기 : p5.js Web editor



# AI 서비스 만들기 : p5.js Web editor





# 실습

- 3개의 클래스(label)을 학습시켜, 모델을 만들고, p5.js를 사용하여 분류 앱을 만들어 보자
  - palm : 손바닥
  - fist : 주먹
  - background : 바탕화면

Teachable Machine Image Model - p5.js and ml5.js



Teachable Machine Image Model - p5.js and ml5.js



Teachable Machine Image Model - p5.js and ml5.js



# palm

The screenshot shows the Teachable Machine web interface in a browser. The URL is <https://teachablemachine.withgoogle.com/train/image>. The interface is divided into several sections:

- Teachable Machine Header:** Includes a menu icon and the text "Teachable Machine".
- 456 이미지 샘플 (456 Image Samples):** A section for training a new model, showing a row of 8 image thumbnails of a hand.
- palm (302 이미지 샘플):** A section for a pre-trained model named "palm", showing a row of 8 image thumbnails of a hand.
- background (347 이미지 샘플):** A section for a pre-trained model named "background", showing a row of 8 image thumbnails of a person's face.
- 클래스 추가 (Add Class):** A dashed box at the bottom with a plus icon and the text "클래스 추가".
- 미리보기 (Preview):** A section on the right showing a live video feed from a webcam. Below the feed, there are three output bars: "fist" (orange), "palm" (red, 100%), and "backg..." (purple).
- 학습 (Training):** A central section with a button "모델 학습 완료됨" (Model training completed) and a dropdown menu "고급" (Advanced).

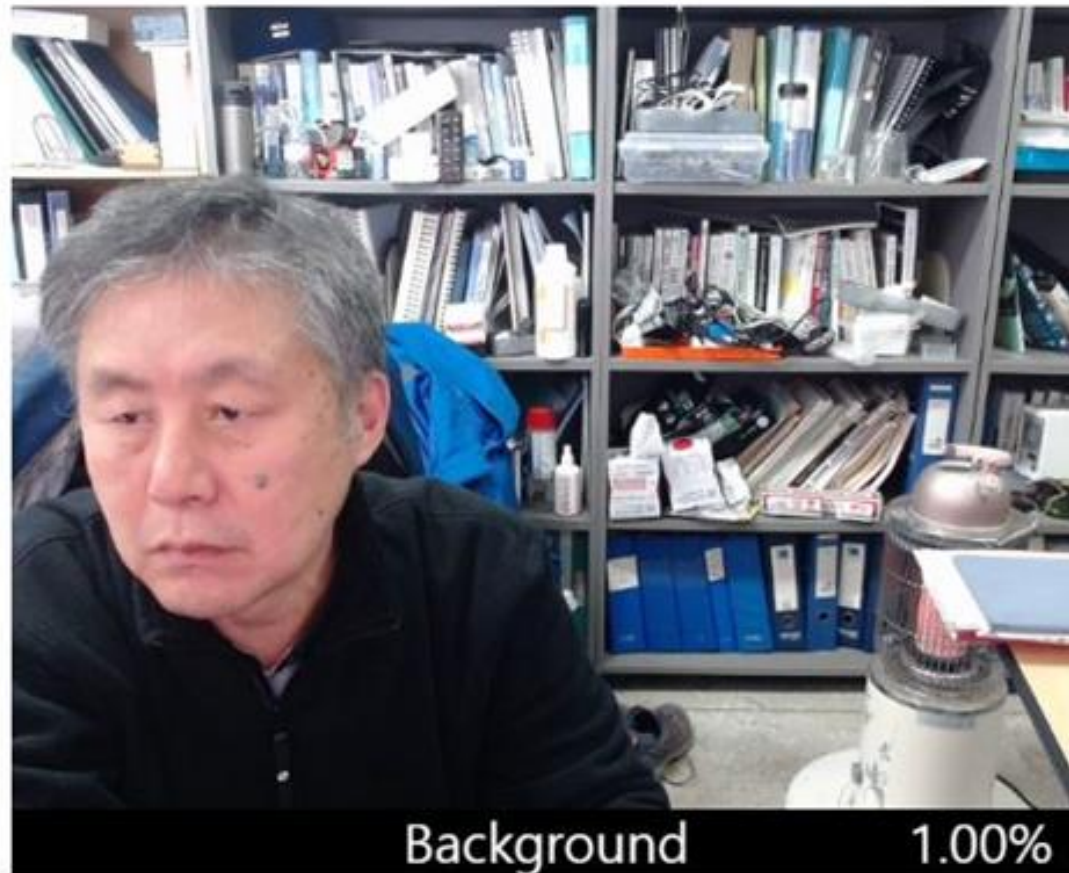
# fist

The screenshot displays the Teachable Machine web interface. On the left, there are three class cards: '456 이미지 샘플' (456 image samples), 'palm' (302 image samples), and 'background' (347 image samples). Each card has a '웹캠' (Webcam) button and an '업로드' (Upload) button. The 'palm' class is currently selected. In the center, a '학습' (Train) button is visible, with a status message '모델 학습 완료됨' (Model training completed). On the right, the '미리보기' (Preview) section shows a live webcam feed of a hand making a fist. Below the feed, the '출력' (Output) section displays the classification results: 'fist' with a 99% confidence score, 'palm', and 'backg...'. The browser's address bar shows the URL 'https://teachablemachine.withgoogle.com/train/image'.



# background


Teachable Machine Image Model - p5.js and ml5.js





# 실습 02 : 가위, 바위, 보 이미지 추론






# 데이터 수집

Paper 


Webcam 






길게 눌러서 녹화하기 

64 이미지 샘플





Rock 

114 이미지 샘플



 

웹캠 업로드





Scissors 

131 이미지 샘플



 

웹캠 업로드




Paper 

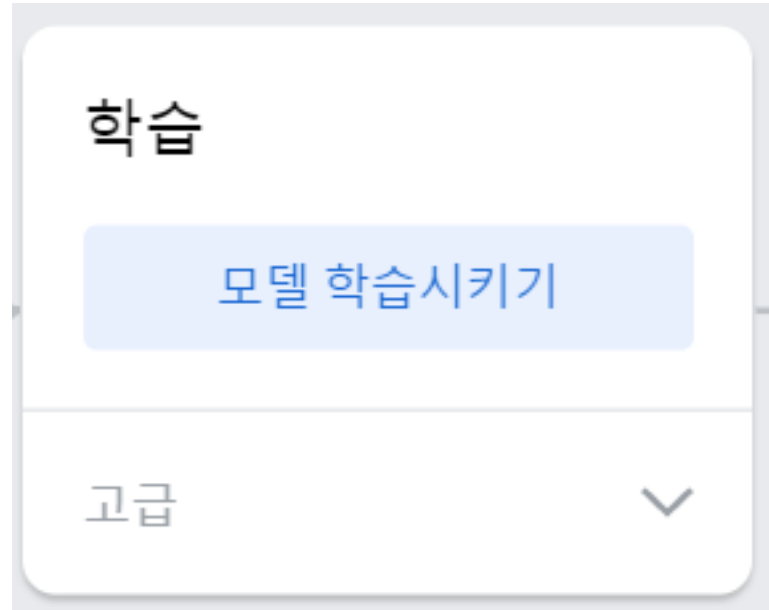
64 이미지 샘플

웹캠 업로드



# 데이터 학습/ 모델 만들기



# 미리 보기


미리  
보기

↑ 모델 내보내기

입력 ☒ 사용

Webcam ▼

↶



⌵

↓

출력

Rock




100%

Sciss...


Paper

# 모델 배포하기

프로젝트에서 모델을 사용하려면 모델을 내보내세요.

Tensorflow.js     Tensorflow     Tensorflow Lite 

모델 내보내기:


☒ 업로드(공유 가능한 링크)    ☐ 다운로드     모델 업로드

공유 가능한 링크:

`https://teachablemachine.withgoogle.com/models/[...]`


모델을 업로드하면 Teachable Machine에서 이 링크에 모델을 무료로 호스팅합니다. (FAQ: 내 모델을 사용할 수 있는 사용자는 누구인가요?)

모델에서 사용할 코드 스니펫:

Javascript    p5.js    Github에 참여 

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:
  // https://github.com/googlecreativelab/teachablemachine-community/tree/master/libraries/image
```

복사 

# AI 서비스 만들기



# 참고

- Teachable Machine : <https://teachablemachine.withgoogle.com/>
- p5js : <https://p5js.org/ko/>