Gesture recognition guide for Web

The MediaPipe Gesture Recognizer task lets you recognize hand gestures in real time, and provides the recognized hand gesture results and the hand landmarks of the detected hands. These instructions show you how to use the Gesture Recognizer for web and JavaScript apps.

You can see this task in action by viewing the demo (https://mediapipe-studio.webapps.google.com/demo/gesture_recognizer). For more information about the capabilities, models, and configuration options of this task, see the Overview (https://ai.google.dev/edge/mediapipe/solutions/vision/gesture_recognizer/index).

Code example

The example code for Gesture Recognizer provides a complete implementation of this task in JavaScript for your reference. This code helps you test this task and get started on building your own gesture recognition app. You can view, run, and edit the Gesture Recognizer example code (https://codepen.io/mediapipe-preview/pen/zYamdVd) using just your web browser.

Setup

This section describes key steps for setting up your development environment specifically to use Gesture Recognizer. For general information on setting up your web and JavaScript development environment, including platform version requirements, see the Setup guide for web (/mediapipe/solutions/setup_web).

JavaScript packages

Gesture Recognizer code is available through the MediaPipe `@mediapipe/tasks-vision` NPM (https://www.npmjs.com/package/@mediapipe/tasks-vision) package. You can find and download these libraries by following the instructions in the platform Setup guide (/mediapipe/solutions/setup_web#downloads).

Attention: This MediaPipe Solutions Preview is an early release. Learn more (/edge/mediapipe/solutions/about#notice).

You can install the required packages through NPM using the following command:

```
npm install @mediapipe/tasks-vision
```

If you want to import the task code via a content delivery network (CDN) service, add the following code in the **<head>** tag in your HTML file:

```
<!-- You can replace JSDeliver with another CDN if you prefer to -->
<head>
  <script src="https://cdn.jsdelivr.net/npm/@mediapipe/tasks-vision/vision_bundle.js"
    crossorigin="anonymous"></script>
</head>
```

Model

The MediaPipe Gesture Recognizer task requires a trained model that is compatible with this task. For more information on available trained models for Gesture Recognizer, see the task overview Models section (https://ai.google.dev/edge/mediapipe/solutions/vision/gesture_recognizer/index#models).

Select and download the model, and then store it within your project directory:

```
<dev-project-root>/app/shared/models/
```

Create the task

Use one of the Gesture Recognizer **`createFrom...()`** functions to prepare the task for running inferences. Use the **`createFromModelPath()`** function with a relative or absolute path to the trained model file. If your model is already loaded into memory, you can use the **`createFromModelBuffer()`** method.

The code example below demonstrates using the `createFromOptions()` function to set up the task. The `createFromOptions` function allows you to customize the Gesture Recognizer with configuration options. For more information on configuration options, see Configuration options (#configuration_options).

The following code demonstrates how to build and configure the task with custom options:

```
// Create task for image file processing:
const vision = await FilesetResolver.forVisionTasks(
  // path/to/wasm/root
  "https://cdn.jsdelivr.net/npm/@mediapipe/tasks-vision@latest/wasm "
);
const gestureRecognizer = await GestureRecognizer.createFromOptions(vision, {
  baseOptions: {
    modelAssetPath: "https://storage.googleapis.com/mediapipe-tasks/gesture_recognize
  },
  numHands: 2
});
```

Configuration options

This task has the following configuration options for Web applications:

Option Name	Description	Value Range	Default Value
`runningMode`	Sets the running mode for the task. There are two modes: IMAGE: The mode for single image inputs. VIDEO: The mode for decoded frames of a video or on a livestream of input data, such as from a camera.	{`IMAGE`, `VIDEO`}	`IMAGE`
`num_hands`	The maximum number of hands can be detected by the `GestureRecognizer`.	`Any integer > 0`	`1`
`min_hand_detection_confidence`	The minimum confidence score for the hand detection to be considered successful in palm detection model.	`0.0 - 1.0`	`0.5`

Option Name	Description	Value Range	Default Value
`min_hand_presence_confidence`	The minimum confidence score of hand presence score in the hand landmark detection model. In Video mode and Live stream mode of Gesture Recognizer, if the hand presence confident score from the hand landmark model is below this threshold, it triggers the palm detection model. Otherwise, a lightweight hand tracking algorithm is used to determine the location of the hand(s) for subsequent landmark detection.	`0.0 - 1.0`	`0.5`
`min_tracking_confidence`	The minimum confidence score for the hand tracking to be considered successful. This is the bounding box IoU threshold between hands in the current frame and the last frame. In Video mode and Stream mode of Gesture Recognizer, if the tracking fails, Gesture Recognizer triggers hand detection. Otherwise, the hand detection is skipped.	`0.0 - 1.0`	`0.5`
`canned_gestures_classifier_options`	Options for configuring the canned gestures classifier behavior. The canned gestures are `["None", "Closed_Fist", "Open_Palm", "Pointing_Up", "Thumb_Down", "Thumb_Up", "Victory", "ILoveYou"]` • Display names locale: the locale to use for display names specified through the TFLite Model Metadata, if any. • Max results: the maximum number of top-scored classification results to return. If < 0, all available results will be returned. • Score threshold: the score below which results are rejected. If set to 0, all available results will be returned. • Category allowlist: the allowlist of category names. If non-empty,	• Display names locale: `any string` • Max results: `any integer` • Score threshold: `0.0-1.0` • Category allowlist: `vector of strings` • Category denylist: `vector`	• Display names locale: `"en"` • Max results: `-1` • Score threshold: `0` • Category allowlist: empty • Category denylist: empty

Option Name	Description	Value Range	Default Value
	classification results whose category is not in this set will be filtered out. Mutually exclusive with denylist. • Category denylist: the denylist of category names. If non-empty, classification results whose category is in this set will be filtered out. Mutually exclusive with allowlist.	`vector of strings`	
`custom_gestures_classifier_options`	Options for configuring the custom gestures classifier behavior. • Display names locale: the locale to use for display names specified through the TFLite Model Metadata, if any. • Max results: the maximum number of top-scored classification results to return. If < 0, all available results will be returned. • Score threshold: the score below which results are rejected. If set to 0, all available results will be returned. • Category allowlist: the allowlist of category names. If non-empty, classification results whose category is not in this set will be filtered out. Mutually exclusive with denylist. • Category denylist: the denylist of category names. If non-empty, classification results whose category is in this set will be filtered out. Mutually exclusive with allowlist.	• Display names locale: `any string` • Max results: `any integer` • Score threshold: `0.0-1.0` • Category allowlist: `vector of strings` • Category denylist: `vector of strings`	• Display names locale: `"en"` • Max results: `-1` • Score threshold: `0` • Category allowlist: empty • Category denylist: empty

Prepare data

Gesture Recognizer can recognize gestures in images in any format supported by the host browser. The task also handles data input preprocessing, including resizing, rotation and value normalization. To recognize gestures in videos, you can use the API to quickly process one frame at a time, using the timestamp of the frame to determine when the gestures occur within the video.

Run the task

The Gesture Recognizer uses the `recognize()` (with running mode `'image'`) and `recognizeForVideo()` (with running mode `'video'`) methods to trigger inferences. The task processes the data, attempts to recognize hand gestures, and then reports the results.

The following code demonstrates how execute the processing with the task model:

ImageVideo (#video)
(#image)

```
const image = document.getElementById("image") as HTMLImageElement;
const gestureRecognitionResult = gestureRecognizer.recognize(image);
```

Calls to the Gesture Recognizer `recognize()` and `recognizeForVideo()` methods run synchronously and block the user interface thread. If you recognize gestures in video frames from a device's camera, each recognition will block the main thread. You can prevent this by implementing web workers to run the `recognize()` and `recognizeForVideo()` methods on another thread.

For a more complete implementation of running a Gesture Recognizer task, see the code example (https://codepen.io/mediapipe-preview/pen/zYamdVd).

Handle and display results

The Gesture Recognizer generates a gesture detection result object for each recognition run. The result object contains hand landmarks in image coordinates, hand landmarks in world coordinates, handedness(left/right hand), and hand gestures categories of the detected hands.

The following shows an example of the output data from this task:

The resulted `GestureRecognizerResult` contains four components, and each component is an array, where each element contains the detected result of a single detected hand.

- Handedness

  Handedness represents whether the detected hands are left or right hands.

- Gestures

  The recognized gesture categories of the detected hands.

- Landmarks

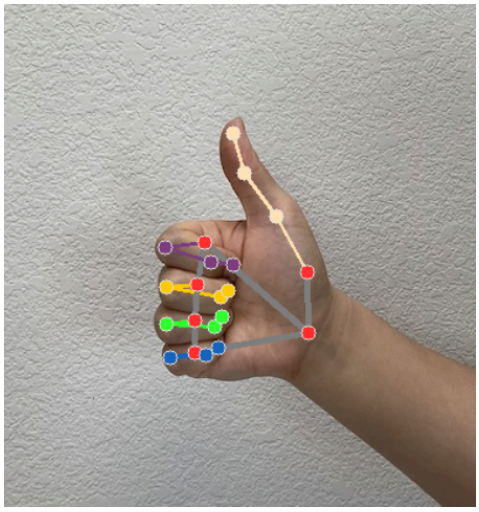
  There are 21 hand landmarks, each composed of **x**, **y** and **z** coordinates. The **x** and **y** coordinates are normalized to [0.0, 1.0] by the image width and height, respectively. The **z** coordinate represents the landmark depth, with the depth at the wrist being the origin. The smaller the value, the closer the landmark is to the camera. The magnitude of **z** uses roughly the same scale as **x**.

- World Landmarks

  The 21 hand landmarks are also presented in world coordinates. Each landmark is composed of **x**, **y**, and **z**, representing real-world 3D coordinates in meters with the origin at the hand's geometric center.

```
GestureRecognizerResult:
  Handedness:
    Categories #0:
      index        : 0
      score        : 0.98396
      categoryName : Left
  Gestures:
    Categories #0:
      score        : 0.76893
      categoryName : Thumb_Up
  Landmarks:
    Landmark #0:
      x            : 0.638852
      y            : 0.671197
      z            : -3.41E-7
    Landmark #1:
      x            : 0.634599
      y            : 0.536441
      z            : -0.06984
    ... (21 landmarks for a hand)
  WorldLandmarks:
    Landmark #0:
      x            : 0.067485
      y            : 0.031084
      z            : 0.055223
    Landmark #1:
      x            : 0.063209
      y            : -0.00382
      z            : 0.020920
    ... (21 world landmarks for a hand)
```

The following images shows a visualization of the task output:



For a more complete implementation of creating a Gesture Recognizer task, see the code example (https://codepen.io/mediapipe-preview/pen/zYamdVd).

Last updated 2025-01-13 UTC.