**Image recognition**

**We work in Choregraphe 2.5.10.7 program**

In this tutorial, we will explain about the specification/behaviour of image recognition system implemented in Pepper through creating some sample applications on Choregraphe.

For this tutorial, the hardware Pepper robot is required to simulate the applications as image recognition system cannot be simulated on the virtual robot.

**Sensor specifications**

1. two 2D cameras (forehead **[A]** & mouth **[B]**)

2. 3D camera (infrared exposure **[C]**, infrared detection **[D]**)

A white robot with red eyes

Description automatically generated with medium confidence

Pepper uses these cameras to process human and object recognition.

**Using Choregraphe to Check the Image Input**

Image input from Pepper’s camera can be checked on Choregraphe.

*Video monitor pane:*

Video monitor pane is used to manipulate the image input.

Go to **[View]** menu and select **[Video monitor]** to open the pane.

A picture containing text, indoor, screenshot

Description automatically generated

It allows you to check the image input as well as to control Vision Recognition Database.

1. Camera image: image input from Pepper’s camera
2. Play/Pause button: on Play, outputs the real-time input from the camera
3. Learn button: switch to image learning mode
4. Import button: import Vision Recognition Database from local file to Choregraphe
5. Export button: export Vision Recognition Database from Choregraphe to local file
6. New button: create new Vision Recognition Database
7. Send button: send current Vision Recognition Database to Pepper

*Monitor Application:*

You may also check the image input with Monitor application which is installed along with Choregraphe.

1. Open Monitor desktop application



2. Select [**Camera**] from the menu

Graphical user interface, text, website

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3. Select your Pepper or enter IP address to connect with the application

Graphical user interface

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4. Click on the [**Play**] button

Graphical user interface

Description automatically generated

5. Now you can check the camera input from Pepper on the Monitor Desktop window

Graphical user interface, website

Description automatically generated

You may click on the Pause button to stop showing the image

6. The information relating to the image recognition can also be checked with the Monitor Desktop. For example, you can check Pepper’s face recognition processing state **[B]** by ticking the box next to face detection **[A]**.

Graphical user interface, application

Description automatically generated

7. To check the input of 3D camera, go to [Load Plugin] menu and select [3dsensormonitor].

Application

Description automatically generated with medium confidence

1. The Depth Map Image is now shown on the Monitor Desktop.

Graphical user interface, application

Description automatically generated

The Monitor application allows you to check and manipulate Pepper’s image recognition input in detail.

**Face Recognition**

By using the Face Detection box provided in the default box libraries in Choregraphe, the information about current number of faces detected by Pepper can be achieved. In this tutorial, we will use Say Text box to make Pepper say the number of faces it’s detecting.

1. Prepare the boxes.

* Sensing > Vision > Human Detection > **Face Detection**
* Speech > Creation > **Say Text**

2. Connect the boxes

Diagram

Description automatically generated

By connecting the “numberOfFaces” output of **Face Detection** box to the **Say Text** box’s “onStart” input, Pepper is able to say the number of faces it’s detecting.

Now the application is ready to be initiated. To check the operation, please connect to Pepper and run the application. When Pepper recognises human faces, Pepper will say the number of faces it’s detecting, like “One” “Two”… and so on.

Graphical user interface

Description automatically generated

You may also check the positions of faces Pepper is detecting on the Robot View pane.

The yellow face icon appears on the Robot View that represents the position while Pepper is detecting human faces.

**Face Tracking**

We can also make Pepper track the face it’s detecting. In this tutorial, we will use Face Tracker box to make Pepper move towards the face.

1. Prepare the boxes.

Sensing > Vision > Human Detection > **Face Tracker**

2. Connect the box.

A picture containing graphical user interface

Description automatically generated

3. Set parameters of the Face Tracker box.

Change the “Mode” parameter to [**Move**] and click OK. Graphical user interface, table

Description automatically generated

Now the application is ready to be initiated. To check the operation, please connect to Pepper and run the application. When Pepper detects someone nearby, it tracks the face by only moving its head around, but when you keep looking at Pepper and slowly move away from it, it should move towards you.

**Learning Faces**

We will now use the Learn Face box to make Pepper learn and remember the face. In this tutorial, we will make Pepper remember the face as “John” 5 seconds after the application starts running.

1. Prepare the boxes.

Programming > Data Edition > **Text Edit**

Sensing > Vision > Human Detection > **Learn Face**

2. Connect boxes.

Diagram

Description automatically generated

3. Insert “John” into the **Text Edit** box.

Diagram

Description automatically generated with medium confidence

Now the application is ready to be initiated. To check the operation, please connect to Pepper and run the application. Move into the face recognition zone and wait for 5 seconds. Pepper’s eyes will turn green if it properly learned your face, and turn red if not.

Data of learned faces can be deleted by running the **Unlearn All Faces** box.

**Face Distinction**

After making Pepper learn faces, we will make Pepper distinct who’s face it’s detecting and then say the name of the face.

1. Prepare the boxes.

Sensing > Vision > Human Detection > **Face Reco.**

Speech > Creation > **Say Text**

2. Connect boxes.

Diagram

Description automatically generated with medium confidence

Now the application is ready to be initiated. To check the operation, please connect to Pepper and run the application. If Pepper says “John” when it detects your face, the application is running successfully.

Try making Pepper learn multiple faces and test if it can distinct each face correctly.

**Learning Image Input**

To make Pepper learn the image input, we will use Video Monitor pane on Choregraphe. In this tutorial, we will make Pepper learn NAO in the Pepper Studio.

1. Connect Choregraphe and Pepper, make sure that the target object is shown on the **Video Monitor,** then click Learn button.

A picture containing text, indoor, computer

Description automatically generated

2. Click on anywhere on the edge of the target object.

3. Keep clicking on the edge of the target object and connect the dots to surround the object.

4. Click on the starting point at the end. The region of target object is now selected.

A group of toy figurines on a table

Description automatically generated with low confidence

5. Insert appropriate information into the name field on the Object Tags dialog box.

Graphical user interface, application

Description automatically generated

6. Click on “Send current vision recognition database to the robot” button.

Graphical user interface, application

Description automatically generated

Now Pepper recognises the shape characteristic of NAO and distinct it as “NAO”.

**Image distinction**

We will now make Pepper say what it’s looking just like what we did for the face recognition and distinction.

1. Prepare the boxes.

Sensing > Vision > Surroundings > **Vision Reco.**

Speech > Creation > **Say Text**

2. Connect the boxes.

Diagram

Description automatically generated

Make sure to connect the “onPictureLabel” output and "onStop" input of **Vision Reco.** box, as well as “onStopped” output of **Say Text** box and “onStart” input of **Vision Reco.** box. This allows the **Vision Reco.** box to stop playing while Pepper is talking and then start playing after Pepper is done talking.

Now the application is ready to be initiated. To check the operation, please connect to Pepper and run the application. If Pepper says the name of the object when it detects it, then the application is running successfully.

Please try using these boxes to explore various functionalities of image recognition system.