Tiny introduction to fiducial markers

Exploring a set of applications of Aruco fiducial markers

Artificial Vision Applications

University of Córdoba

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ⓘ Introduction

The objective of this project is to get an insight into the functioning of fiducial markers, exploring some of their possibilities and restrictions, defining an example application using the OpenCV library and the Ovis module.

The concepts explored in this work are fundamentally:

» Understanding what are the detections of the aruco fiducial markers.

» By using the detections, to compute the homography and to apply a patch using it.

» By using the detections, to estimate the pose and to use it by reprojecting a piramid.

» By using estimated pose and the Ovis package, set a 3D object in the scene, customized or by default, being translated and rotated as an aruco marker does.

✎ Prerequisites

In order to execute the project is being used **OpenCV 4.5.5**, **Ogre 13.3.3**, the IDE **Visual Studio Code** and the operating system **Ubuntu 20.04.4 LTS**. Keeping in mind when configuring the libraries:

• The package **contrib** of opencv with the same version.

• The acceptance of the **nonfree** package.

• The connection to the Ogre compilation performed.

• The acceptance of the package from **ovis**.

🗒 Suggestions on the Ovis installation

Look for the needed dependencies for Ogre in this link. In my case, only was needed to:

• Install the following dependencies:

```
>_ sudo apt-get install libgles2-mesa-dev libvulkan-dev glslang-dev
   libxrandr-dev.
>_ sudo apt-get install libsdl2-dev libxt-dev libxaw7-dev doxygen.
```

• Plus having **activated** the CMake variable, when configuring Ogre before compiling, **OGRE_BUILD_DEPENDENCIES**.

In addition, it is necessary to have a camera available and having printed the **markers print**.

›_ Executables

The executables configured for the project are classified into auxiliary and main executables. To disable the generation of executables with Ovis, set the variable **use_of_ovis** to **FALSE** in the CMakeLists.txt file.

» Auxiliar executables

> **Aruco markers printing**. Executable that is usefull if you wanna print on your own your first Aruco markers using OpenCV.

> **Ovis installation test**. Executable that is usefull if you wanna test if the ovis installation is correct.

» Main executables

> **Main application**. Main executable where some applications of the fiducial markers are built and shown. Aruco markers are looked for. For every detected marker with:

`[Id:   1 ]` The pose is estimated and a piramid is reprojected on the marker.

`[Id:   2 ]` A customized dectection drawing is performed.

`[Id:   3 ]` The homography is computed and a patch is applied on the marker.

> **Main application + Ovis**. Application where, having already the functionalities of the base application, we explore a bit the Ovis module, by the use of 3D objects. An Ogre entity or a personalized model entity will be translated and rotated in line with the estimated pose of identifier marker 1.

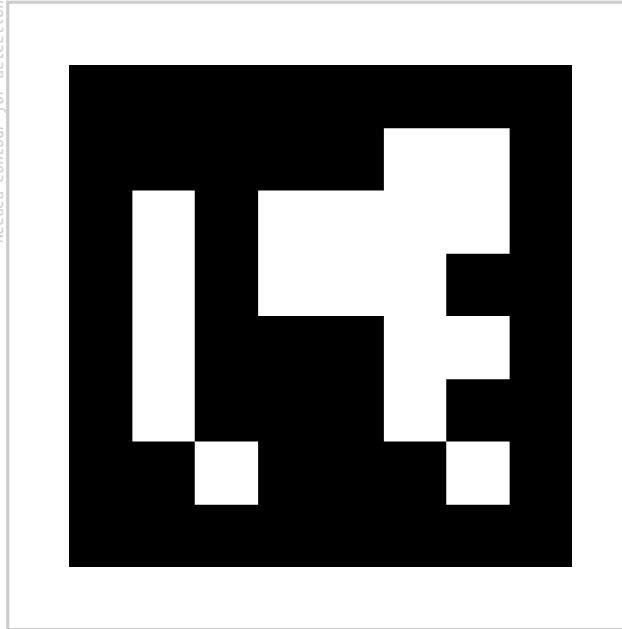For more information see the contents of the **README.md** file.

📄 Markers print

```
/*
    ~ Aruco markers example set ~
     > Dictionary: DICT_6X6_250
*/
```
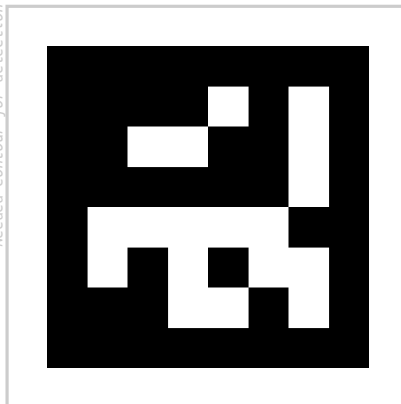
Marker **1**

Needed contour for detection

Marker **2**

Needed contour for detection

Marker **3**

Needed contour for detection