

## **Augmented Reality**

### **Exercise 1 – Setting things up**

In this exercise, we will build upon the game engine Godot (3.5.3 LTS) and the computer vision library OpenCV (4.9.0). In order to use OpenCV within Godot, we need to use the GDNative API. As a first step, we will run an example project doing just that.

What we need for the setup:

- A camera
- Download Godot 3.5.3 LTS at <https://godotengine.org/>
- Download OpenCV 4.9.0 matching your OS at <https://opencv.org/get-started/>
- Get the example project from <https://github.com/lukacu/bouncy>
- Compiling the bouncy/native/ part of the example project:
  - Edit the <bouncy-repo>/native/CMakeLists.txt to include the line  
SET(OpenCV\_DIR <path-to-opencv>/opencv-4.9.0/build/x64/vc16/lib)  
right before the line  
FIND\_PACKAGE(OpenCV REQUIRED)
  - Depending on your OS, follow the specific instructions in Moodle to compile the C++ code
- Copy the compiled bouncy library as well as opencv\_world490 and opencv\_world490d to <bouncy-repo>/native/, then (in Godot) edit the bouncy.gdnlb by checking the path to the bouncy library as well as adding the OpenCV libraries under dependencies.
- Run the project
- Understanding what's happening:
  - Check the camera object in the Gameplay.gd script in combination with the <...>/native/wrapper.c file to see how calls are made from Godot to the native library
  - <...>/native/camera.cpp (especially the constructor) to see how OpenCV opens a camera feed and runs a thread reading new frames

## **Exercise 2 – Getting familiar with Godot**

To get a little more familiar with Godot and how to do 3D transformations, input and UI pick the „3D Rotate Direct Constant Smooth“ Demo from the Project Asset Library and play around with it.

Try changing a few things like direction of rotation, introducing a translation, reacting to other inputs or UI elements.

Then try other demos as well and look at their code!

## **Exercise 3 – Scalar Product**

- a) What is the definition of a scalar product (dot product) of two vectors?

$$\vec{a} \cdot \vec{b} =$$

- b) Calculate the scalar product for

$$\vec{a} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}; \vec{b} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}$$

- c) Calculate the angle  $\xi$  between vectors a and b.