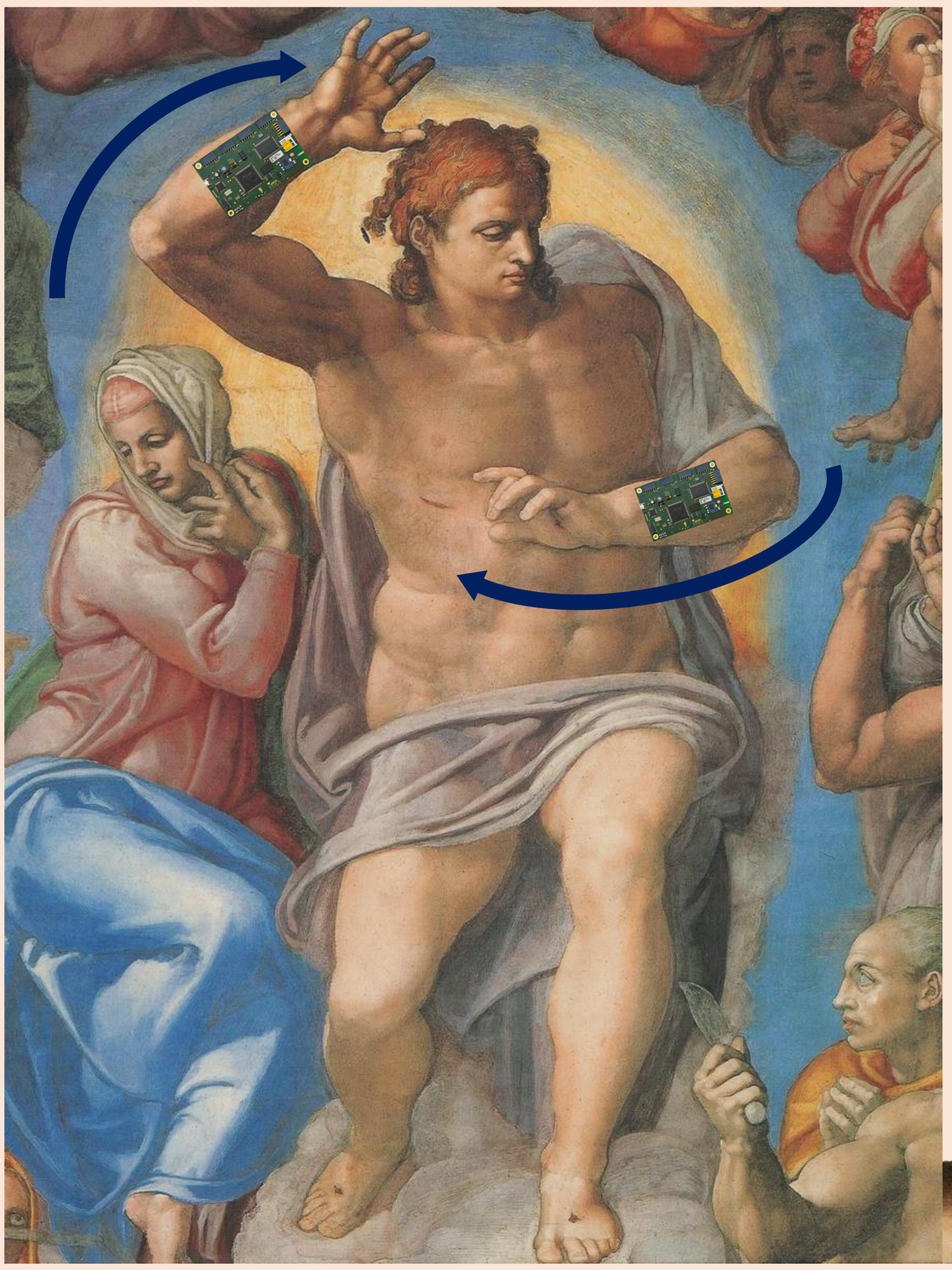
Sensor fusion for gesture recognition on an Internet of Things device

By Sebastien Gios with Peter Van Roy as supervisor 2022-2023

- **Internet of Things** devices are small computers with embedded hardware and minimal software.
- More and more present in everyday life (home automation, household). They can be equipped with many sensors and collect data or have a small motor to perform a physical movement.
- But as they are present in the human environment, **interaction** with them should be **simple and reliable.**
- Our goal is to **recognize human gesture**, using only an IoT device.
- No cloud or other dependencies because of the many disadvantages.
- This gesture can then be used to control another device.

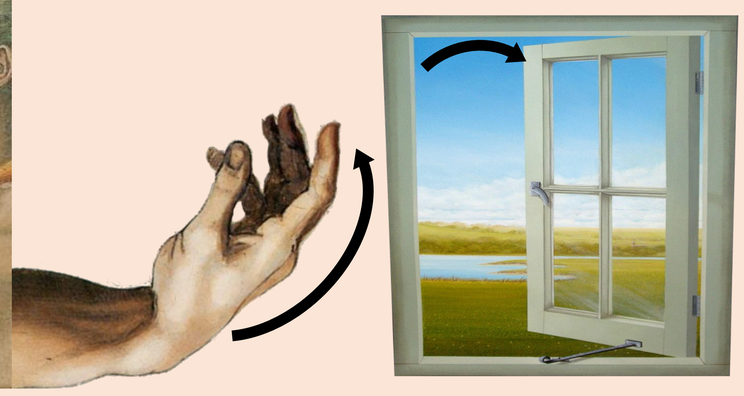
GRiSP

- GRiSP is a **prototype board** for IoT that supports Erlang and Elixir on bare hardware.
- GRiSP has sockets for attaching 5 PMOD **sensors** and actuators.
- PMOD devices include **navigation**, barometer, humidity, range finding, motor control, etc.



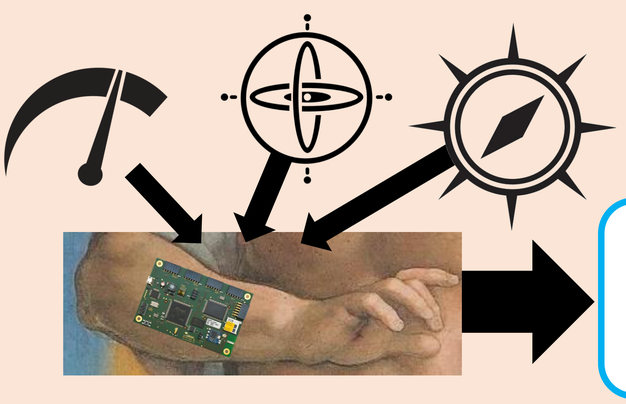
Approach

- **Program a IoT** device capable of learning and recognize gestures.
- Gesture can simple or complex.
- We will **combine** data from **sensors** passed through a filter. Then **recognize** the different gesture with a **classifier**.
- For example, point a device which is a window, then do the gesture to open it.



Sensor Fusion

- Fusion of **3 sensors** from PMOD-NAV: an accelerometer, a gyroscope and a magnetometer.
- Sent to a **Kalman Filter**. It estimates the state of a system from measurements. Robust against incomplete data and noise.
- Return an **acceleration and velocity in real time**.
- Sent to the ML algorithm to recognize the gesture.



Machine Learning

- To recognize a gesture, we use a **general classifier**.
- It sorts data in different categories. Each category will be a different gesture.
- Feed with initial data so it can train on them.
- When you move, it **recognizes the gesture**.
- It could be a circle with your hand, or a forward line to point a direction.