

## SCOPE

VOD, ODE and AR modules are designed to be used as **primary detection tools** which are able to provide the project's system with **raw object/activity detections**.

Those detections are essential for **scene semantic interpretation** and, thus, play a crucial role at feeding the project's further modules with vital information. The latter information is being used for the **situation analysis and the decision making**, regarding the possibly required mitigation measures.. The raw detections are being collected and propagated in the physical correlator of 7SHIELD for further analysis. Additionally, ODE includes a mechanism for receiving the telemetry information from the UAV.

## CONTRIBUTION

M4D, part of CERTH, is a group intensively involved in miscellaneous European Projects, starting from 7 Framework Programme (FP7) and more extensively in H2020 projects.

It focuses mainly in the areas of **computer vision, semantic multimedia analysis and retrieval**, web data mining, multimodal analytics and decision support, crisis management, fight crime and terrorism, border surveillance and digital security, Earth Observation and Migration and applies these technologies mainly in the health, and **security domain**.

M4D focuses on developing cutting-edge technologies and solutions to be applied to real problems.

## MODULES

- Video-Based Object Detection (VOD)
- Object Detection at the Edge (ODE)
- Activity Recognition (AR)



Detection



Situational Awareness

## PARTNERS



**CERTH**  
Greece

The **Centre for Research and Technology-Hellas (CERTH)**, founded in 2000, is the largest Research Centre in Northern Greece. It is governed by private law, while it has a non-profit status and it's supervised by the General Secretariat for Research and Innovation (GSRI) of the Greek Ministry of Development & Investments.

Besides other institutes, it contains the **Information Technologies Institute (ITI)**, which is the largest institute of CERTH. ITI is one of the leading Institutions of Greece in the fields of Informatics, Telematics and Telecommunications.

The **Multimedia, Knowledge and Social Media Analytics Lab (MKLab)** is one of the research units of ITI institute. The MKLab has active involvement in numerous Horizon 2020, FP7 and National projects. The **Multimodal Data Fusion and Analytics (M4D)** group is part of the MKLab.

All the modules developed in the frame of 7SHIELD have been designed with the consultancy of identified external stakeholders, first responders and following the **requirements** provided by the partners working in the space sector acting as Pilots, who provided the Critical Infrastructures for **testing and demonstration**.

## PURPOSE

In the context of 7SHIELD platform the main purpose of both Video-based Object Detection (VOD) and Object Detection at the Edge (ODE) is to **recognize and identify all objects of interest** depicted in the provided input video (or video stream). By this detection a **semantic interpretation** of the scenery being monitored is feasible to be provided to the system.

On the other hand, Activity Recognition (AR) module aims at **detecting any potential suspicious activity** performed by the human subjects that have been detected.

## STAKEHOLDERS

VOD, ODE and AR modules are essential for any task that involves **automation of scene analysis, early warning and surveillance purposes**. Within this aspect, the innovation for this module is a combination of **flexible detections**, which include detections in **restricted zones** and **versatile frameworks**, which include typical powerful workstations/servers, as well as more lightweight on board graphic cards for early and on site detections.

The advantages of these modules are the **ability to constantly monitor specific areas**, to **provide detections for unreachable** or at least difficultly accessed **regions** and to easily combine it with other means of surveillance if necessary, by ground segment operators.

## CONTACTS

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## TECHNOLOGY

VOD and ODE use **state-of-the-art object detection** modules which have been tested on various use cases. They are developed using a well-known framework tensorflow and python. For its training and usage (inference) it is necessary to use a **GPU card for efficiency reasons**.

Even though the modules can operate on typical CPU mode, this impacts highly the system performance and it is not recommended as an option.

The **project's datasets** being utilised for the algorithms' training, have been compiled of various **publicly available datasets** and with the sole purpose to fit the project's end user requirements. Special care was given to the efficiency of the algorithm to be used. AR uses standard methods for deciphering the activities of each person and do not require a GPU to function.

## FUTURE IMPROVEMENTS

Further improvement of the modules can be achieved if **larger number of relevant images** have been gathered and annotated. Ideally, **diverse images** should be collected to cover different aspects of e.g., viewpoints, distance, illumination, occlusion, height of capture. When necessary, **different datasets** which include additional or even completely different objects of interest can be used for training models with **different detection capabilities**. Finally, if future models possess a larger effectiveness for the same resources switching to such models, efficiency could be improved.