

## HSDetAI

Performant and highly efficient AI-based object detection methods for Heimann Sensor Infrared Thermopile Array Sensors

HSDetAI is a library containing object detection and object tracking models specifically tailored to Heimann Sensor Thermopile Arrays (HTPA). While their performance matches that of Deep Learning models, they are very efficient and capable of running on Single-Board Computers like the Raspberry Pi and even microcontroller systems.

### Model Overview

All models are so-called Two-Stage Detectors, i.e. they consist of two algorithms, that run consecutively: The first scans the image for Regions of Interest (RoI), the second classifies these regions of interest. In order to enhance performance even further, the detector is itself wrapped in a tracking algorithm developed by Heimann Sensor.

The resulting model is simply fed with consecutive sensor images  $I$  and returns a table containing the bounding boxes of detected objects.

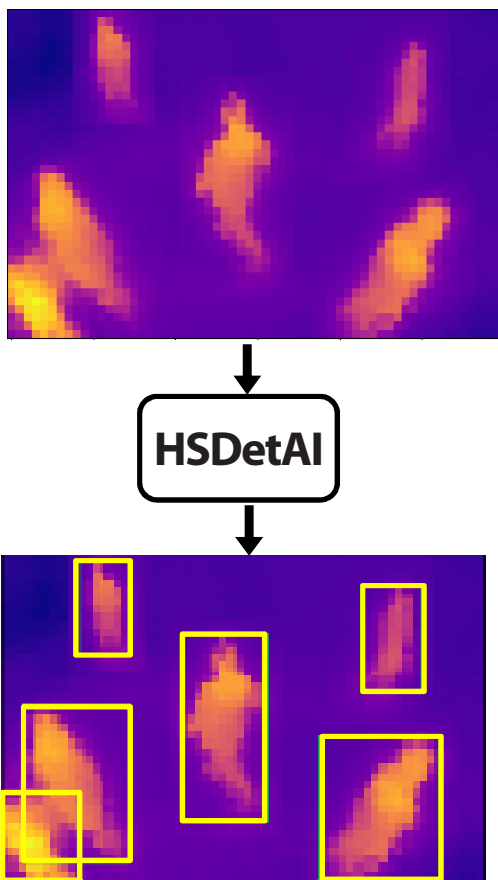


Figure 1: Input Output Flow of HSDetAI

### Comparison to Deep Learning

Because HSDetAI is perfectly tailored to specific sensors and applications, it achieves the same performance as Deep Learning Models, but requires only a fraction of the memory and computational resources that Deep Learning Models use.

Table 1: Qualitative comparison between Deep Learning Models and HSDetAI Models

	Deep Learning	HSDetAI
No. of Parameters	Millions	Thousands
Memory Requirements	5 MB – 100 GB+	<1MB
Computational Requirements	High, needs at least an NVIDIA Jetson Nano	Low, needs as little as an MCU

### Customized Models

Heimann Sensor offers ready-to-use models for standard applications such as person detection from different camera perspectives. For non-standard customer applications Heimann Sensor is prepared to develop customized models using self-recorded or customer data and its proprietary training algorithms.

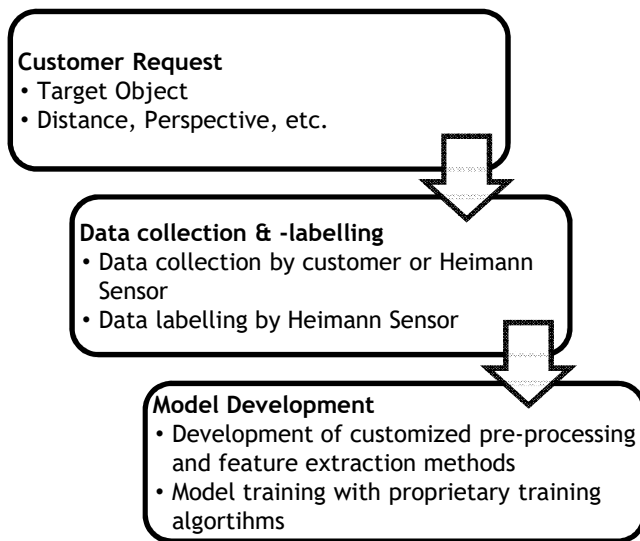


Figure 2: Development Workflow for customized object detection models

### Supported Platforms

HSDetAI is distributed as pre-built library that customers can easily integrate in their Python or C++ application. Depending on the platform, the following files are provided

Table 2: Distributed files depending on customer operating system / platform

Platform	Distributed file formats
Windows 10 and higher	.dll
Linux	.so
ESP32	.a