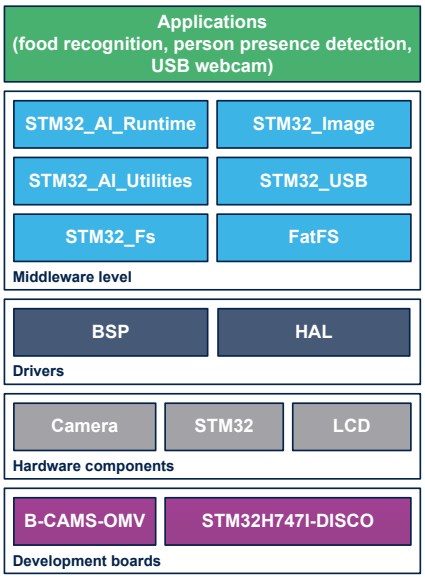
FP-AI-VISION1

Data brief

Artificial Intelligence (AI) and computer vision function pack for STM32Cube



Product status link
FP-AI-VISION1

Features

- Complete firmware to develop a computer vision application on STM32 microcontroller
- Image pre-processing library (STM32_Image)
- Neural Network library optimized for STM32 (STM32_AI_Runtime) generated by means of the X-CUBE-AI Expansion Package for STM32CubeMX
- Food recognition application based on Convolutional Neural Network
- Person presence detection application based on Convolutional Neural Network
- USB webcam application enabling the STM32H747I-DISCO board to act as a USB video camera (UVC) device when connected to a host
- Integration examples based on float and quantized models
- Libraries enabling the test, debug and validation of the embedded application
- Support for camera frame capture to enable image dataset collection
- Sample implementations available for the STM32H747I-DISCO Discovery board connected to the B-CAMS-OMV camera module bundle
- Free and user-friendly license terms

Description

FP-AI-VISION1 is an STM32Cube function pack featuring examples of computer vision applications based on Convolutional Neural Network (CNN).

FP-AI-VISION1 is composed of software components generated by the X-CUBE-AI Expansion Package complemented with application software components dedicated to the AI-based computer vision application.

The application examples provided in the function pack are food recognition (recognizing among 18 classes of common food), and person presence detection (identifying whether a person is present in the image or not).

FP-AI-VISION1 implements advanced computer vision application using STM32_AI_Runtime Neural Networks libraries. Libraries are based on pre-trained models and are generated with the X-CUBE-AI Expansion Package for the STM32CubeMX tool.

The function pack demonstrates the integration of two types of Neural Network model: 32-bit floating-point model and 8-bit quantized model. It also demonstrates model integration in different memory configurations (relying only on MCU internal memory or using also external memories).

The FP-AI-VISION1 function pack features an image library, STM32_Image, that can be used to develop specific computer vision applications, together with the suggested combination of hardware boards. It includes various processing functions to process the content of the frame buffer.

The FP-AI-VISION1 function pack also includes the drivers for the camera as well as the framework for capturing images into the frame buffer, preprocessing the content of the frame buffer, and running the Neural Network inference.

The FP-AI-VISION1 function pack features a USB webcam application, which can be used to create image and video datasets as well as to perform live testing on the host. The FP-AI-VISION1 runs on the STM32H747I-DISCO Discovery board connected to the B-CAMS-OMV camera module bundle (advised) or STM32F4DIS-CAM camera daughterboard (legacy only).

1 General information

The FP-AI-VISION1 function pack runs on STM32 microcontrollers based on Arm® cores.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

1.1 Ordering information

FP-AI-VISION1 is available for free download from the *www.st.com* website.

1.2 What is STM32Cube?

STM32Cube is an STMicroelectronics original initiative to significantly improve designer's productivity by reducing development effort, time, and cost. STM32Cube covers the whole STM32 portfolio.

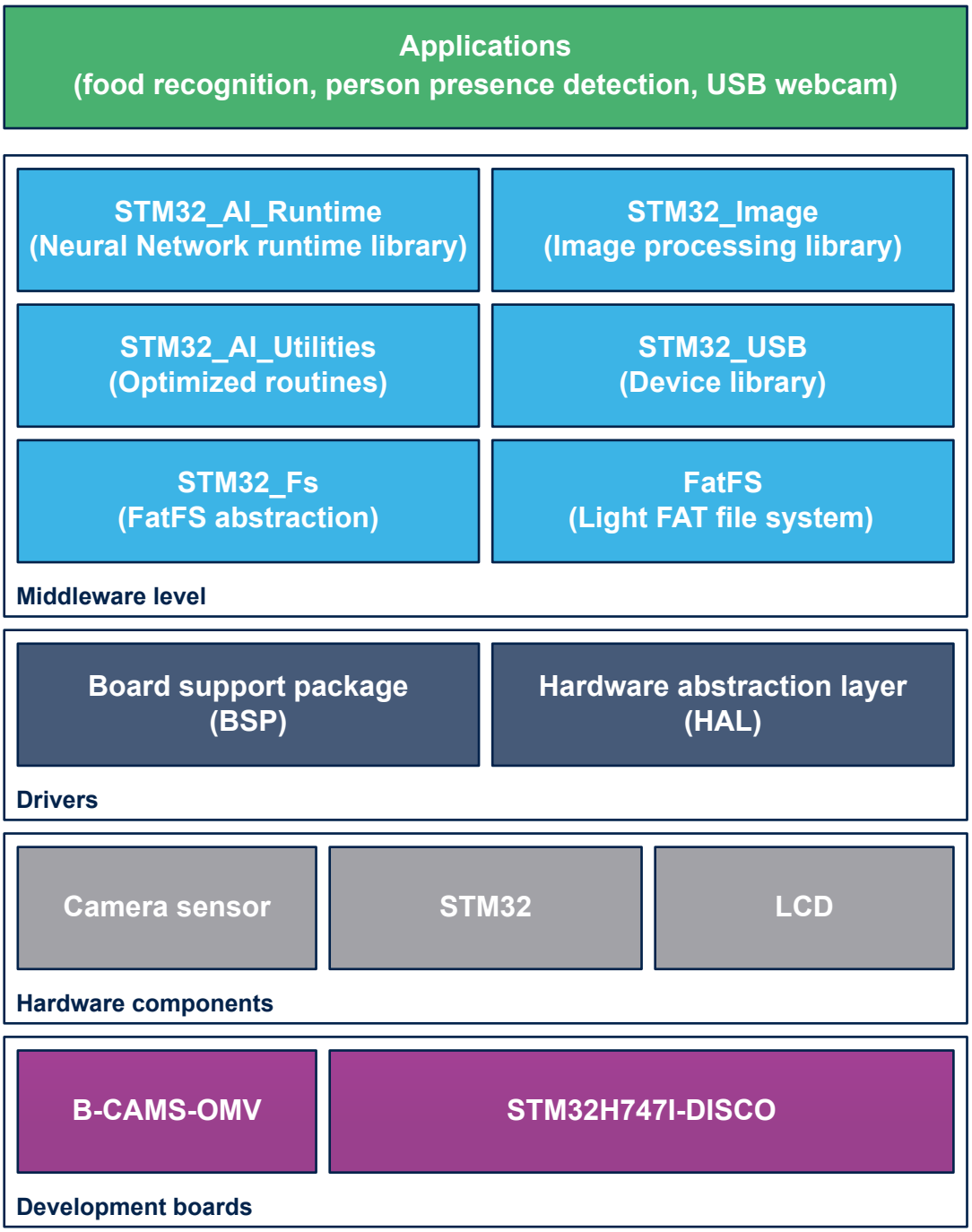
STM32Cube includes:

- A set of user-friendly software development tools to cover project development from conception to realization, among which are:
  - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
  - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
  - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
  - STM32CubeMonitor (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD) powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real-time
- STM32Cube MCU and MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeH7 for the STM32H7 Series), which include:
  - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over hardware
  - A consistent set of middleware components such as RTOS, USB, TCP/IP, FAT file system, audio, and graphics
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU and MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

2 Global architecture

The top-level architecture of the FP-AI-VISION1 function pack usage is shown in Figure 1.

Figure 1. FP-AI-VISION1 architecture



3 License

FP-AI-VISION1 is delivered under the *Mix Ultimate Liberty+OSS+3rd-party V1* software license agreement (SLA0048).

The software components provided in this package come with different license schemes as shown in Table 1.

Table 1. Software component license agreements

Software component	Copyright	License
Board support package (BSP)	STMicroelectronics	BSD-3-Clause
Cortex®-M CMSIS	Arm Limited	Apache License 2.0
HAL STM32H7	STMicroelectronics	BSD-3-Clause
STM32H747I-DISCO BSP drivers	STMicroelectronics	BSD-3-Clause
STM32H7xx CMSIS	Arm Limited - STMicroelectronics	Apache License 2.0
FatFS	ChaN	BSD-3-Clause
STM32_Fs	STMicroelectronics	The MIT License
STM32_AI_Runtime	STMicroelectronics	Proprietary
STM32_AI_Utilities	STMicroelectronics	Proprietary
STM32_Image	STMicroelectronics	Proprietary
STM32_USB_Device_Library	STMicroelectronics	Proprietary
Applications	STMicroelectronics	Proprietary

Revision history

Table 2. Document revision history

Date	Revision	Changes
19-Jul-2019	1	Initial release.
24-Dec-2019	2	Added the support for the debug and validation of the embedded application and for camera frame capture in *Features* and *Description*. Updated figures and *Software component license agreements* for the FAT file system.
23-Jul-2020	3	Added person presence detection: updated *Features*, *Description*, *License* and top-level architecture views. Updated *What is STM32Cube?*
17-Feb-2021	4	Added the USB webcam application and the use of the B-CAMS-OMV camera module bundle: updated Features, Description, License and the top-level architecture views.