

# SONY



# Vision and Sensing Application SDK Development Container Functional Specifications

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# 1. Change history

Date	What/Why
2022/11/16	Initial draft
2023/01/30	Directory structure change. Added or modified features provided by the SDK. Updated the PDF build environment.

## 2. Terms/Abbreviations

Terms/Abbreviations	Meaning
Dev Container	A Docker container with a software development environment available in GitHub Codespaces and VS Code. This SDK is provided based on Dev Container
Cloud App	AI application running in Cloud with data processed by post-processing application as input

### 3. Reference materials

- Reference/Related documents
  - Codespaces
    - <https://docs.github.com/ja/codespaces>
  - VS Code Remote Development
    - <https://code.visualstudio.com/docs/remote/remote-overview>
  - VS Code Codespaces extension
    - <https://marketplace.visualstudio.com/items?itemName=GitHub.codespaces>
  - VS Code Remote Development Extension Pack
    - <https://marketplace.visualstudio.com/items?itemName=ms-vscode-remote.vscode-remote-extensionpack>
  - CVAT
    - <https://github.com/opencv/cvat>
  - MCT
    - [https://github.com/sony/model\\_optimization](https://github.com/sony/model_optimization)
  - COCO
    - <https://cocodataset.org/#home>

## 4. Expected use case

- You want to reduce the effort by using an environment that already contains the components needed for development
- You want to use an environment that doesn't depend on other environments
- You want your team to use the same environment
- You want to understand an overview of the entire workflow for AI application development by trying it out with sample code
- You want to develop smoothly even without knowledge of AI application development

# 5. Functional overview/Algorithm

## Functional overview

- Provides a container environment for developing AI applications
  - The container environment can be used in the following ways:
    - Using Codespaces
      - There are two types of UI: Browser and VS Code desktop
    - Build a container environment on your Local PC and use it from VS Code
  - The container environment includes:
    - Tools and operating environments available for each AI application development workflow
    - Procedure in each workflow
    - Sample code
      - See the following [AI application development workflows and features to provide](#) for details



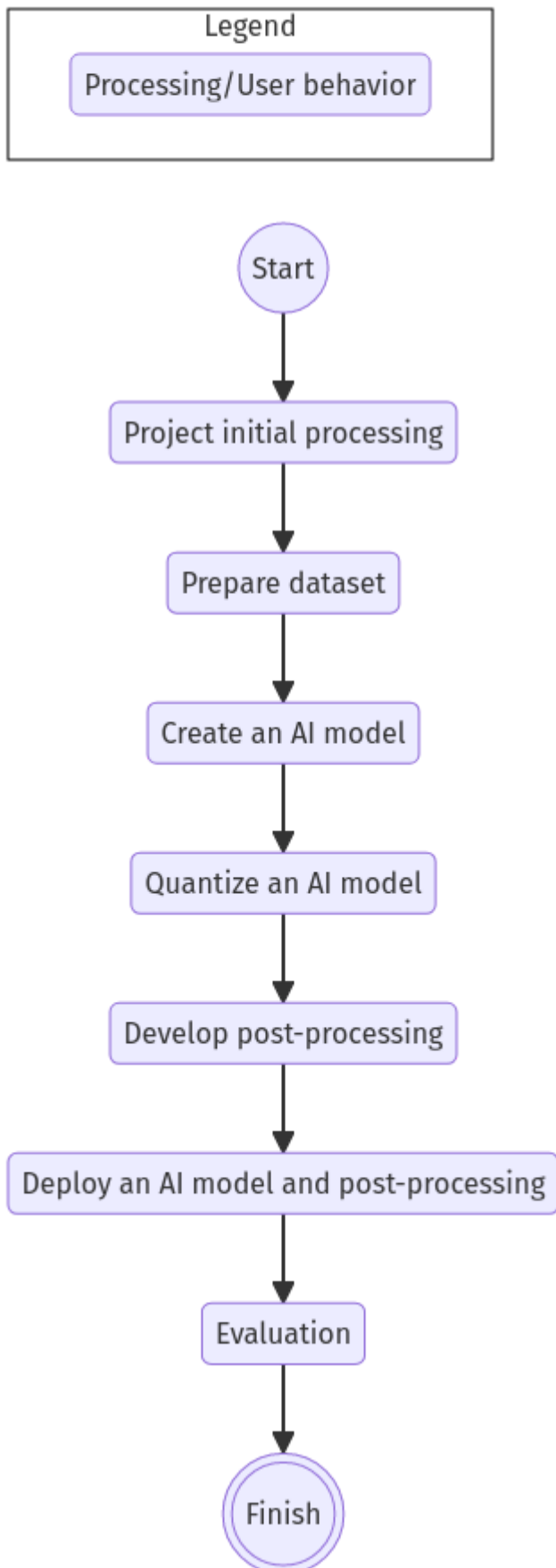
Specific details of each function contained in a container are described in the functional specifications of each function, not in this document.

- Users can get information needed to develop AI applications
  - Users can view documentation for each workflow in AI application development
  - Users can view functional specifications

## Others Exclusive conditions / specifications

- Does not provide Docker images
- Does not provide build environment for firmware of edge AI devices
- Provides reference links for the sample Cloud App

## AI application development workflows and features to provide





## Features provided by the SDK

Workflow	Deliverables (documents)	Deliverables (runtime environment, sample)
Project initial processing	<ul style="list-style-type: none"><li>• Console for AITRIOS procedure</li></ul>	-
Prepare dataset	<ul style="list-style-type: none"><li>• Procedure for annotating using CVAT</li><li>• Console for AITRIOS procedure</li></ul>	<ul style="list-style-type: none"><li>• Environment where CVAT can be used</li><li>• Notebook to download images from COCO</li><li>• Notebook importing and exporting datasets from CVAT</li><li>• Notebook that splits datasets for train/validate</li></ul>
Create an AI model	<ul style="list-style-type: none"><li>• Procedure for transfer learning an AI model (Image Classification)</li><li>• Console for AITRIOS procedure</li></ul>	<ul style="list-style-type: none"><li>• Sample notebook for transfer learning an AI model (Image Classification)</li></ul>
Quantize an AI model	<ul style="list-style-type: none"><li>• Procedure for quantizing a user-created AI model (Image Classification) using MCT</li><li>• Procedure for evaluating the accuracy of a user-created AI model (Image Classification) before and after quantization</li></ul>	<ul style="list-style-type: none"><li>• Environment for quantization using MCT</li><li>• AI model evaluation environment</li><li>• Sample notebook quantizing an AI model (Image Classification)</li><li>• Sample notebook evaluating the following types of AI models (Image Classification)<ul style="list-style-type: none"><li>◦ Keras</li><li>◦ TFLite</li><li>◦ TFLite (quantized)</li></ul></li></ul>

Workflow	Deliverables (documents)	Deliverables (runtime environment, sample)
Develop post-processing	<ul style="list-style-type: none"> <li>• Procedure to implement and debug post-processing and build it to a Wasm file</li> </ul>	<ul style="list-style-type: none"> <li>• Environment to build post-processing to a Wasm file</li> <li>• Sample code for post-processing (C, C++)</li> <li>• Environment to debug post-processing code</li> </ul>
Import an AI model and post-processing into Console for AITRIOS	<ul style="list-style-type: none"> <li>• Procedure to import AI models and post-processing into Console for AITRIOS using notebook</li> <li>• Console for AITRIOS procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Notebook to import AI models and post-processing into Console for AITRIOS</li> </ul>
Deploy an AI model and post-processing to edge AI devices	<ul style="list-style-type: none"> <li>• Procedure to deploy AI models and post-processing to edge AI devices using notebook</li> <li>• Console for AITRIOS procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Notebook to deploy AI models and post-processing to edge AI devices</li> </ul>
Evaluation	<ul style="list-style-type: none"> <li>• Console for AITRIOS procedure</li> </ul>	-

Other features	Deliverables (documents)	Deliverables (runtime environment, sample)
Version control	<ul style="list-style-type: none"> <li>• Version control examples</li> </ul>	-

## Directory structure for the container

```
/tutorials
  /_common
  /1_initialize
  /2_prepare_dataset
  /3_prepare_model
  /4_prepare_application
  /5_evaluate
/docs/development-docs
/.devcontainer
/README.md
```

# 6. User interface specifications

## Prerequisite

- For Codespaces, be ready to use Codespaces
  - For Codespaces (VS Code desktop), install [VS Code Codespaces extension](#)
- If you want to use VS Code on your Local PC, install [VS Code Remote Development Extension Pack](#)

## Start container

Start the development environment by the following procedure.

- Codespaces (Browser)
  1. Press the [**Create codespace on <branch name>**] from the [**Codespaces**] tab of the [**Code**] in the SDK repository
- Codespaces (VS Code desktop)
  1. Press the [**Create codespace on <branch name>**] from the [**Codespaces**] tab of the [**Code**] in the SDK repository
  2. After creating Codespace, press the [**Codespaces**] in the bottom left of the Codespace browser
  3. Select the [**Open with VS Code**] from the drop-down list
- Local PC
  1. Access the SDK repository from GitHub, clone the SDK repository to your environment, and open it in VS Code
  2. Press the [**>**] mark at the bottom left of VS Code, or press the "Ctrl + Shift + P" to open the command palette and click the [**Reopen in Container**]



To interrupt the container during startup, follow the procedure:

- Codespaces (Browser)
  - Press the [**×**] button in your browser
- Codespaces (VS Code desktop) or using VS Code on a Local PC
  - Press the VS Code's [**×**] button



To check container startup progress, follow the procedure:

- Codespaces (Browser)
  - Press the [**View logs**] when it appears in the Codespaces browser
- Codespaces (VS Code desktop) or using VS Code on a Local PC
  - Press the [**Starting Dev Container (show log)**] from notification in bottom right of VS Code screen

## Get information needed to develop AI applications

The following documents are available:

- Procedure for each workflow of AI application development (README)
  1. Jump from the link in the repository top **README.md** to the **README.md** in the **tutorials** directory of the *Directory structure for the container*
  2. Jump from the link in the **README.md** in the **tutorials** directory to the **README.md** under each feature directory such as **1\_initialize**
- Functional specifications
  1. Jump from the link in the repository top **README.md** to the functional specifications

## 7. Target performances/Impact on performances

- Usability
  - When the SDK environment is built, the container is available for developing AI applications without any additional installation steps
  - Users must be able to navigate the container environment with the VS Code UI

## 8. Assumption/Restriction

- Features provided by the SDK may not work properly depending on the specs of Codespaces or Local PC
  - For Codespaces, a Machine Type of 4-core or higher is recommended

## 9. Remarks

- No error codes and messages defined in the SDK
- Does not specify the UI response time on container startup, as it is affected by the user's network environment for Codespaces and the user's Docker operating environment for Local PC
  - However, both Codespaces and Local PC have a proven UI response within 10 seconds on startup
    - Performance was measured under the following conditions:
      - Codespaces: Select Machine Type 4-core
      - Local PC: Start on a machine with the following specs:

Item	Description
CPU	Intel® Core™ i7-8665U CPU @ 1.90GHz 2.11 GHz
RAM	16.0 GB
OS	Windows 10 version 21H2
WSL2	Ubuntu-20.04



## 10. Unconfirmed items

- None