Towards AI powered manufacturing services, processes, and products in an edge-to-cloud-knowlEdge continuum for humans

Model building with Human in the Loop
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Goals

Goals

- Automatic and generic AI pipeline, to extract, transform, model and exploit knowledge from heterogenous data sources:
  - Automate the process of finding the best model configuration. This frees up data scientists' time and resources, allowing them to focus on other aspects of model development.
  - Keep track of model's modification using the Knowledge Repository.
- Keep track of the performance and validate models before distributing them.
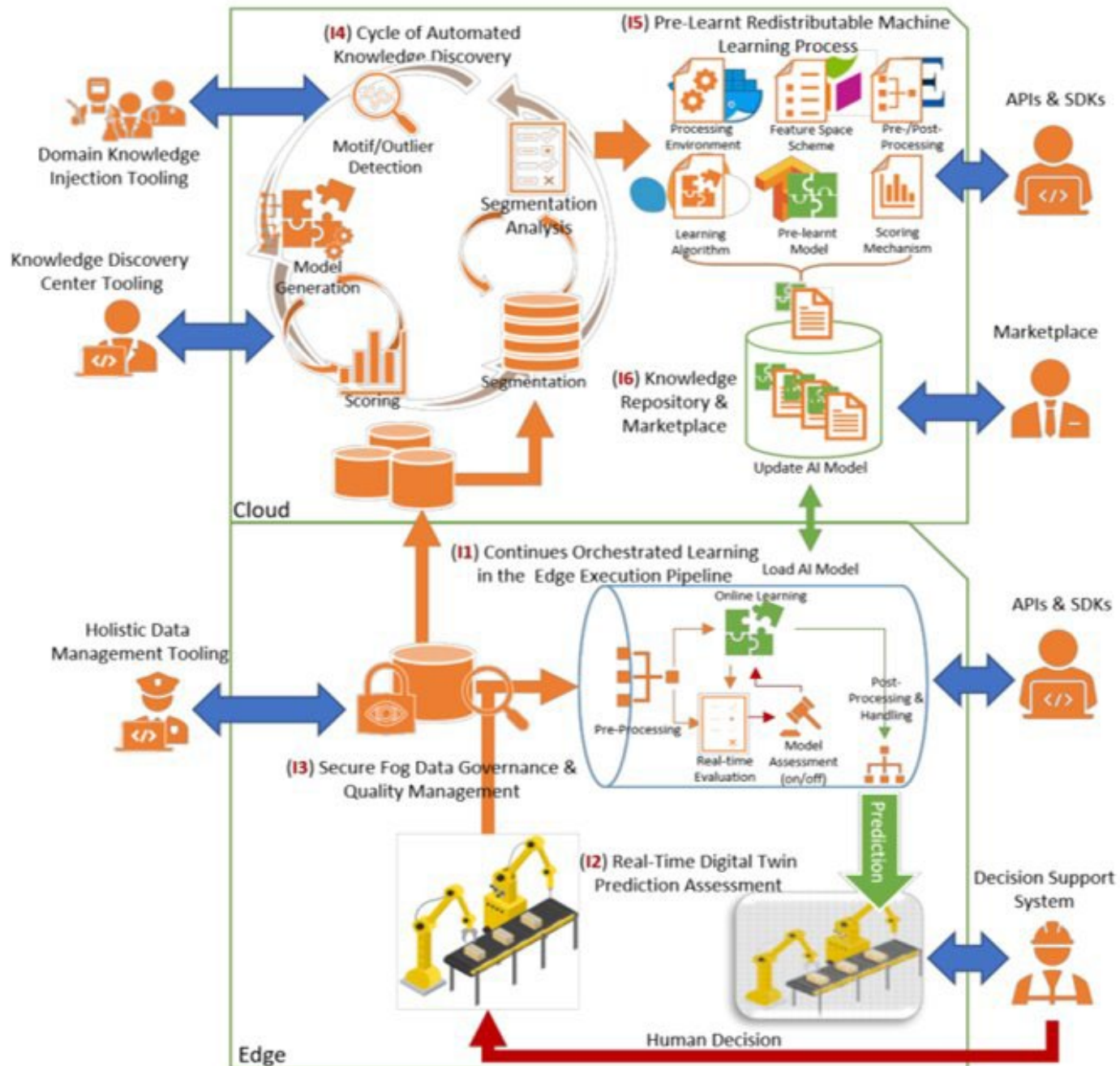
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1. Collect, secure and manage data

2. If no/few labels exist, (semi-)automatize the knowledge extraction process

3. Efficiently create models for predefined scenarios (e.g. predictive maintenance)

4. Upload models to / Download models from a common marketplace

5. Automatically deploy models and evaluate them locally

6. Optionally run them on a digital twin first to avoid problems in the ongoing production process

7. Update models in the marketplace

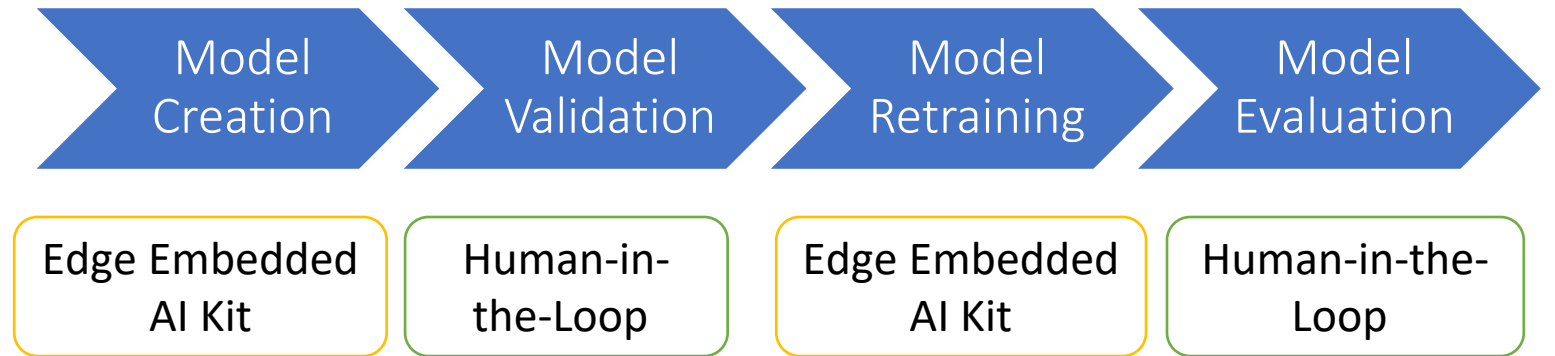AI Model Generation with Human-in-the-Loop

Workflow

Workflow

Edge Embedded AI Kit

- Deploy in the edge, fog, cloud
- Launch training, inference, retraining tasks

Model Creation	Model Validation	Model Retraining	Model Evaluation
Edge Embedded AI Kit	Human-in-the-Loop	Edge Embedded AI Kit	Human-in-the-Loop

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Model Creation

1. **Data analyst fills the input configuration**
2. **The EEK creates an instance using the Orchestrator API**

Edge Embedded AI Kit

Task

Task name (*)

Task type (*)

Select task type

Strategy (*)

Select an strategy

Preprocessor

Select a preprocessor

Labeler

Select a labeler

Action

Action (*)

Select an action

☐ Hyperparamerer tuning
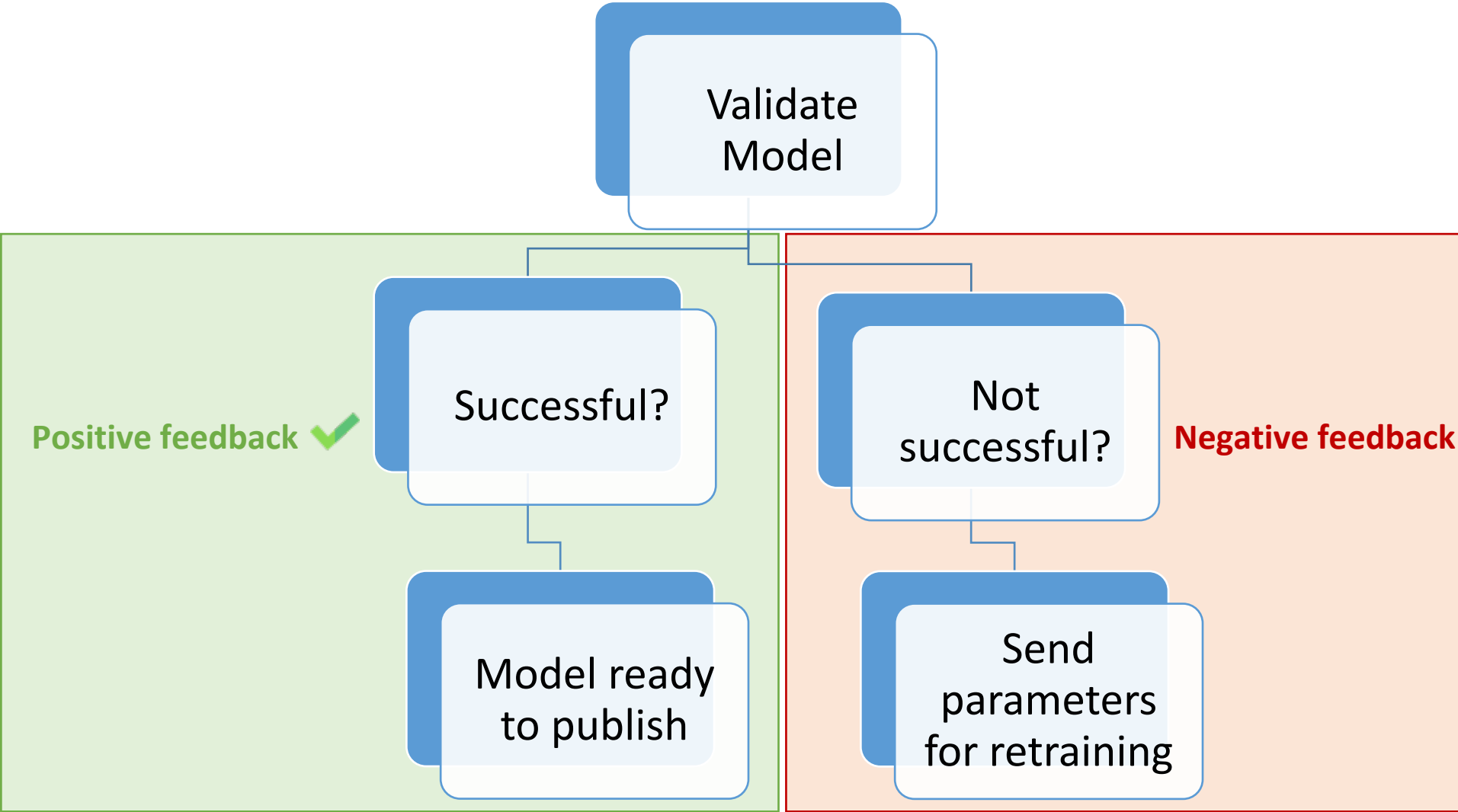
Data

Training data (*)

Select a connector

HDS

Sql query

SELECT last_value(*) FROM root.kautex.shopfloor.kautex.RawData.flowMeasurement.* group by ([2023-

Input attributes

*

Target attribute

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Model Validation

Human-in-the-loop

Validate Model

Positive feedback ✔

Successful?

Model ready to publish

Negative feedback

Not successful?

Send parameters for retraining

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Model Retraining

Negative feedback ✖
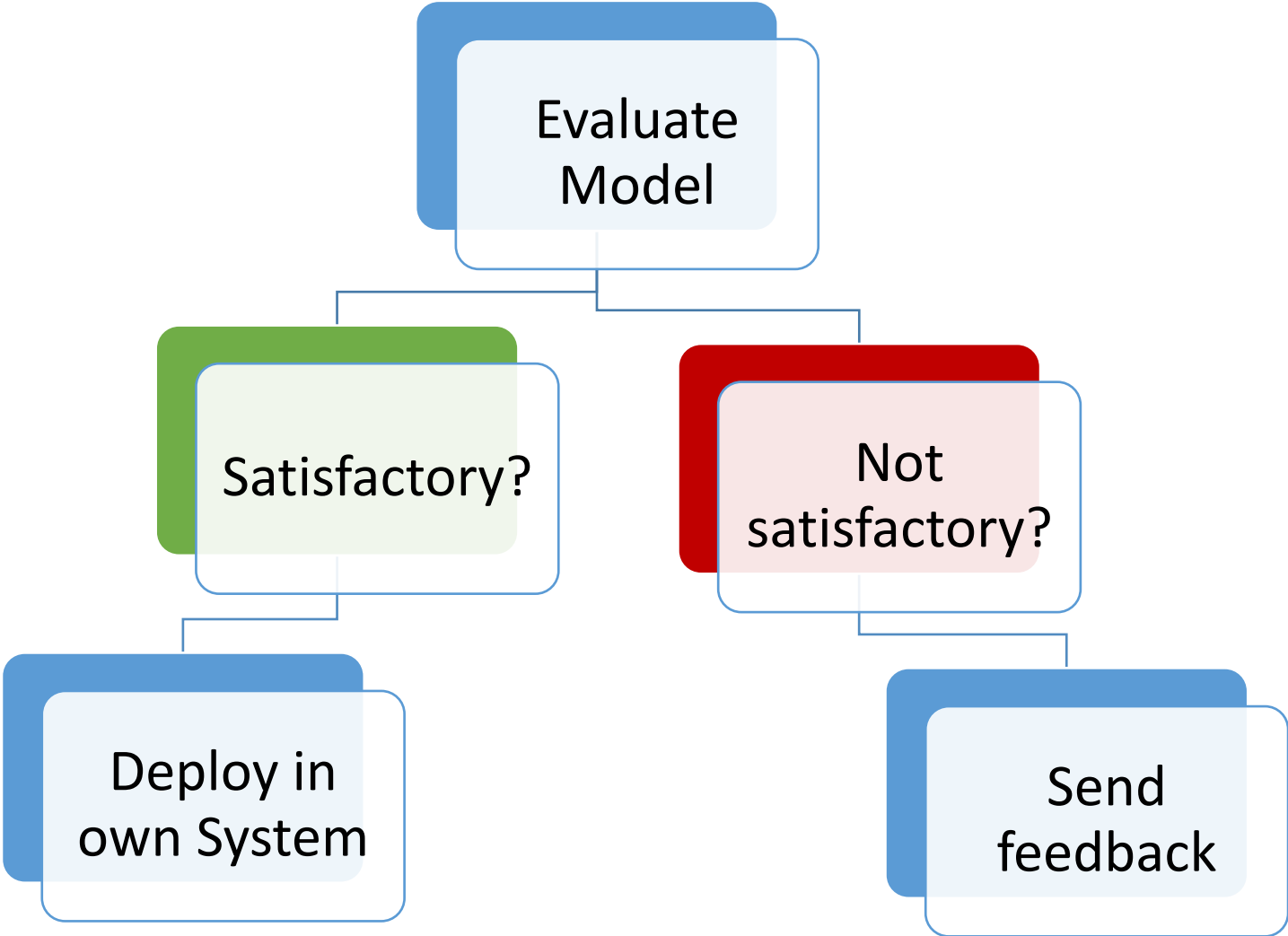


```
{
"model_id": <...>
"hyperparameters": {},
...
}
```
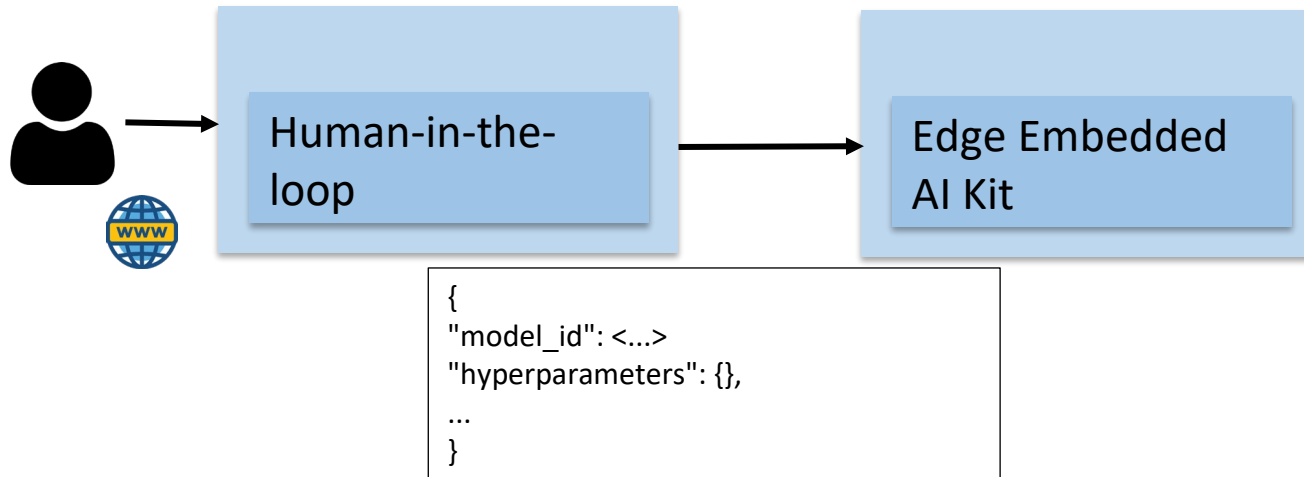
1. **HAI launches the hyperparameter tuning for that model using the EEK API**
2. **The EEK creates an instance using the Orchestrator**
3. **The orchestrator creates and runs the container (AI Task)**

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Model Evaluation

Human-in-the-loop

Evaluate Model

Satisfactory?

Not satisfactory?

Deploy in own System

Send feedback

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Results

Solved Challenges: Human AI In the Loop

- Human domain expert
  - has a say in model development
  - can evaluate a model before deployment

Solved Challenges: Edge Embedded AI Kit & AI Model Generation

Classification
Regression
Optimization

Different problem types supported

> 25 algorithms

Machine Learning &
Deep learning
Scalability is easy
Reproducibility is easy
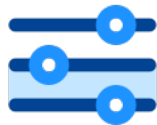
Built on standards
Distributed execution
is possible
Bayesian optimization
(ML)

Hyperparameter tuning

Different data sources

Data is loaded using
different data
connectors

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Demo Video – Model Validation for Retraining
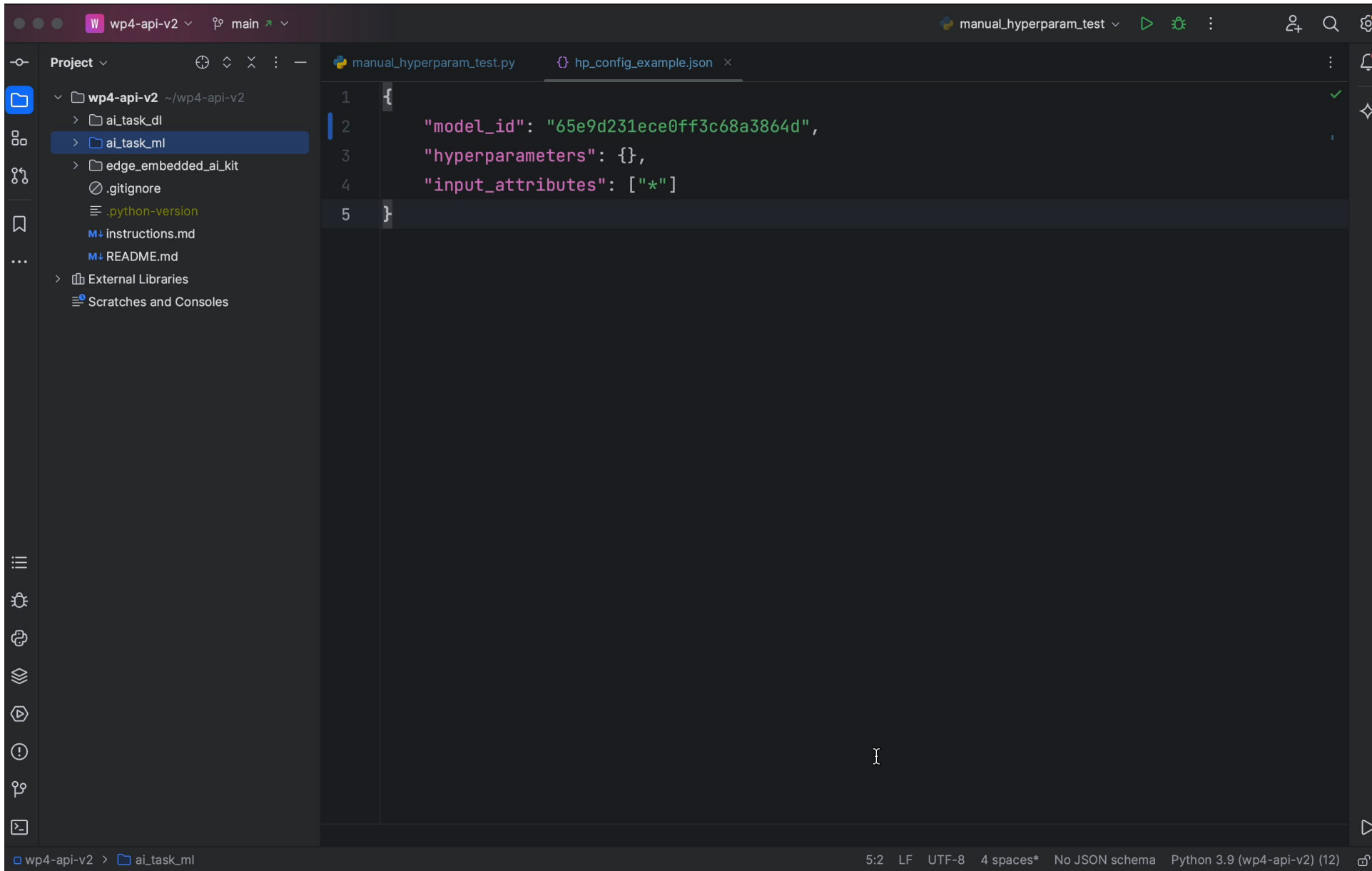
Demo Video – Hyperparameter tuning

Demo Video – Model Evaluation for deployment

Discussion

Questions?