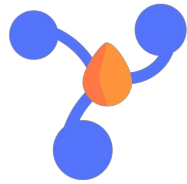




**h\_da**

HOCHSCHULE DARMSTADT  
UNIVERSITY OF APPLIED SCIENCES

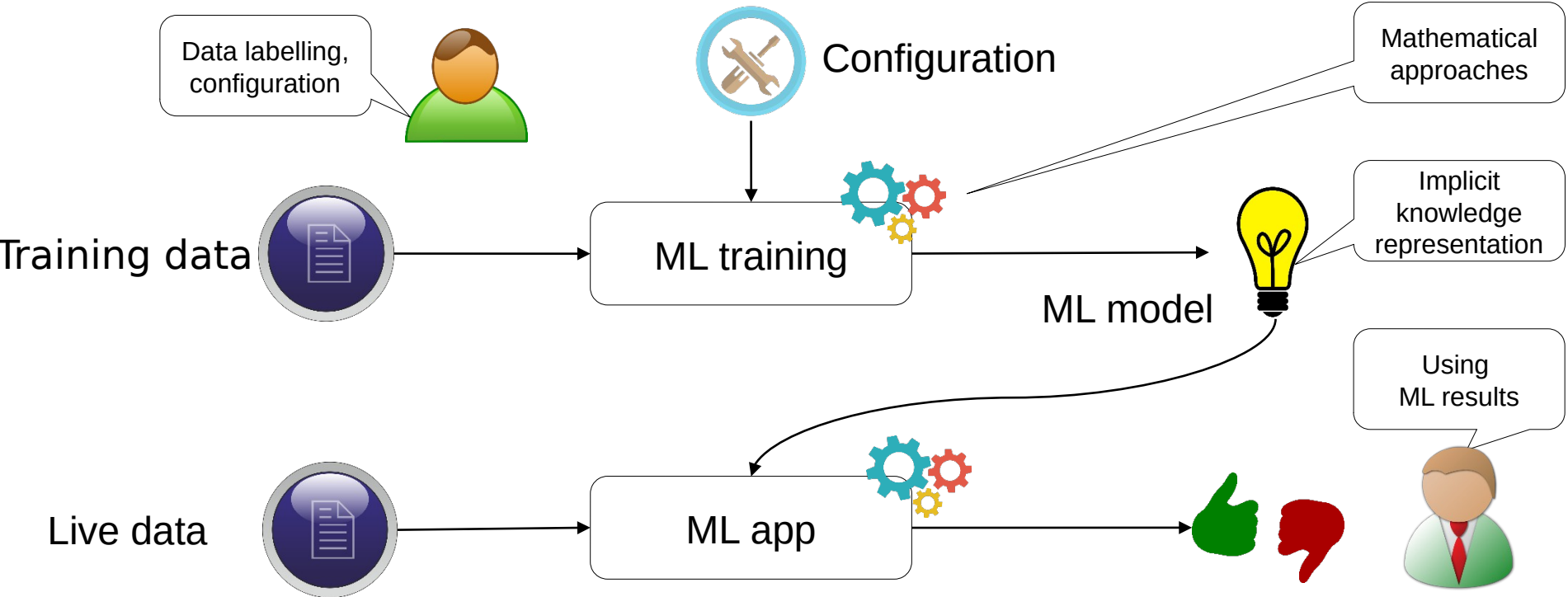


# OMA-ML

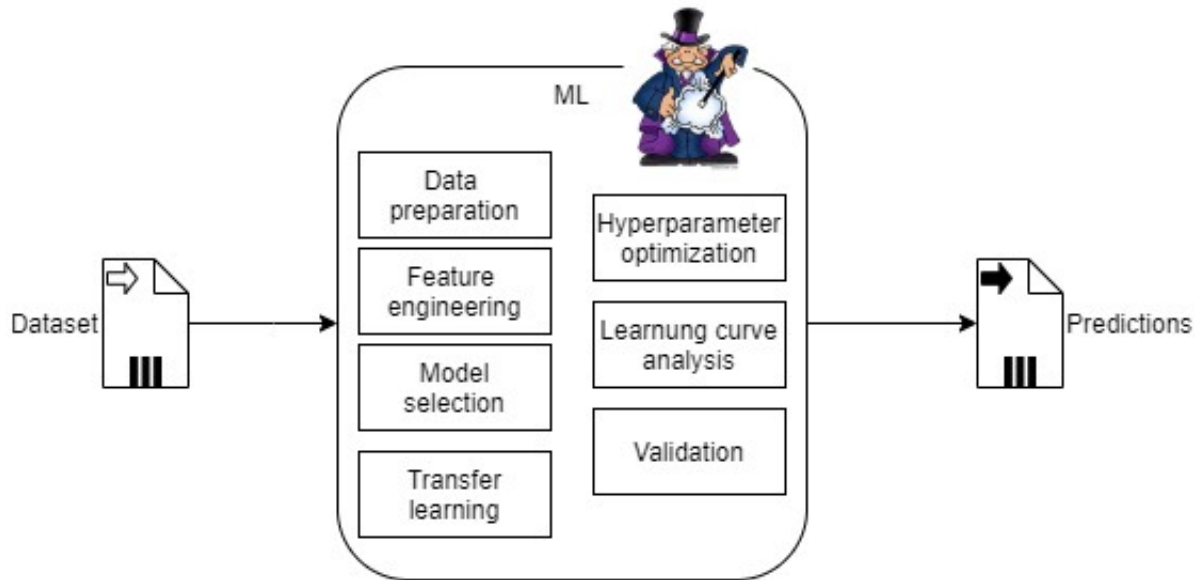
Effective Machine Learning made easy!

Alexander Zender

# WHAT IS MACHINE LEARNING?



Quelle: <https://bigdata-madesimple.com/machine-learning-explained-understanding-supervised-unsupervised-and-r>



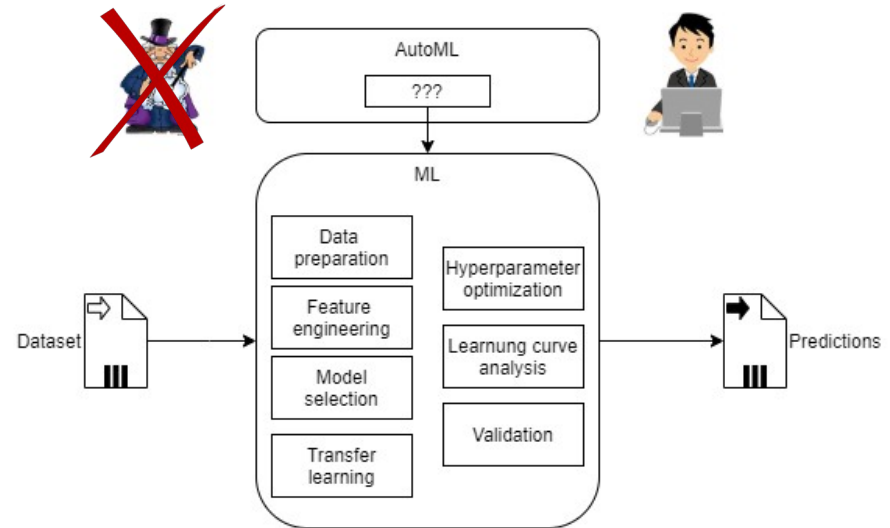
# WHAT IS AUTOML?

## Automated Machine Learning:

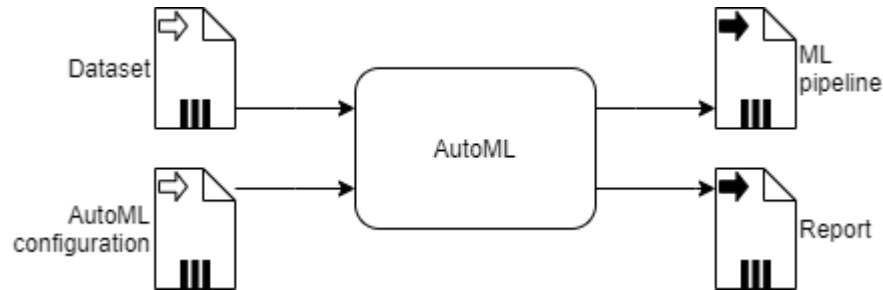
- Aims at automating model selection and hyperparameter optimization
- Leading to potentially higher efficiency and better results

## AutoML user group:

- Anyone with (e.g. data scientist) or without (e.g. domain expert) machine learning knowledge



# INPUT AND OUTPUT OF AUTO-ML



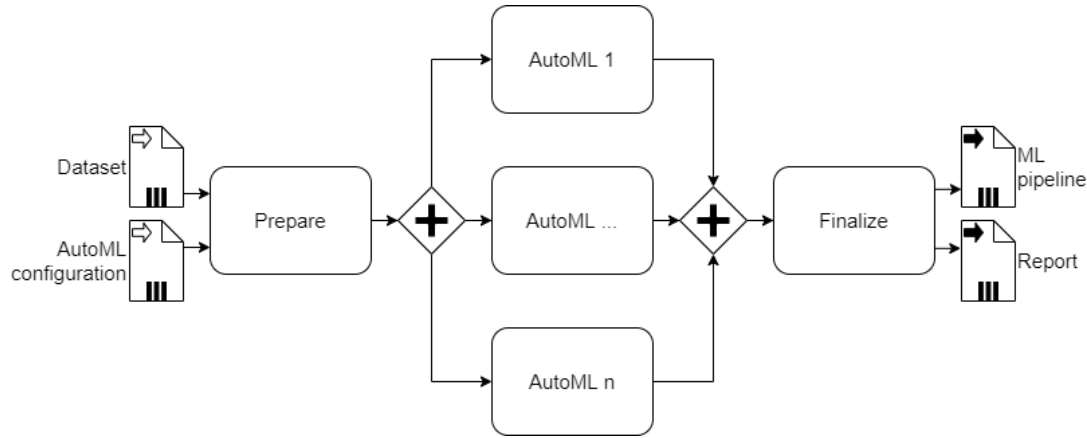
## Input

1. Dataset: ML task specific dataset.
2. AutoML configuration:
  1. ML task
  2. ML target
  3. Additional configuration

## Output

1. ML pipeline: source code and model
2. Report: textual or graphical explanation of the AutoML result

## META AUTO-ML



- AutoML: it shall generate an executable ML pipeline and a report based on a configuration and a dataset.
- User groups: it shall be used by anyone with or without programming skills.
- Technology-independent: it shall support multiple ML libraries.
- ML task: a wide range of ML tasks shall be supported.

# ONTOLOGY BASED META AUTOML

OMA-ML Knowledge base for:

1. the GUI wizard to only display plausible configurations

2. the preprocessing

3. The strategy selection

```
# PREFIXES

@prefix : <http://h-da.de/ml-ontology/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .

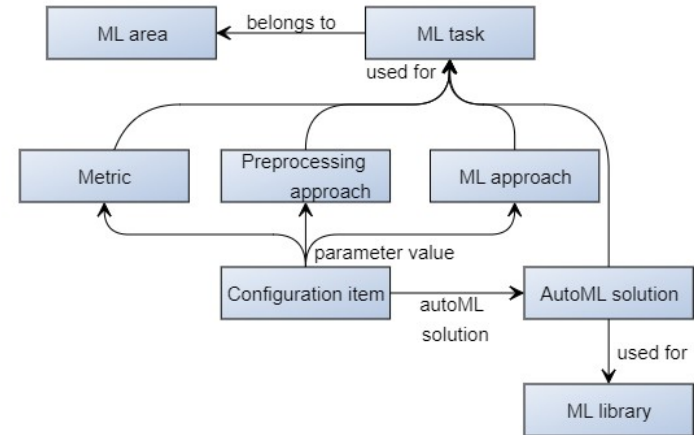
# rdfsClass

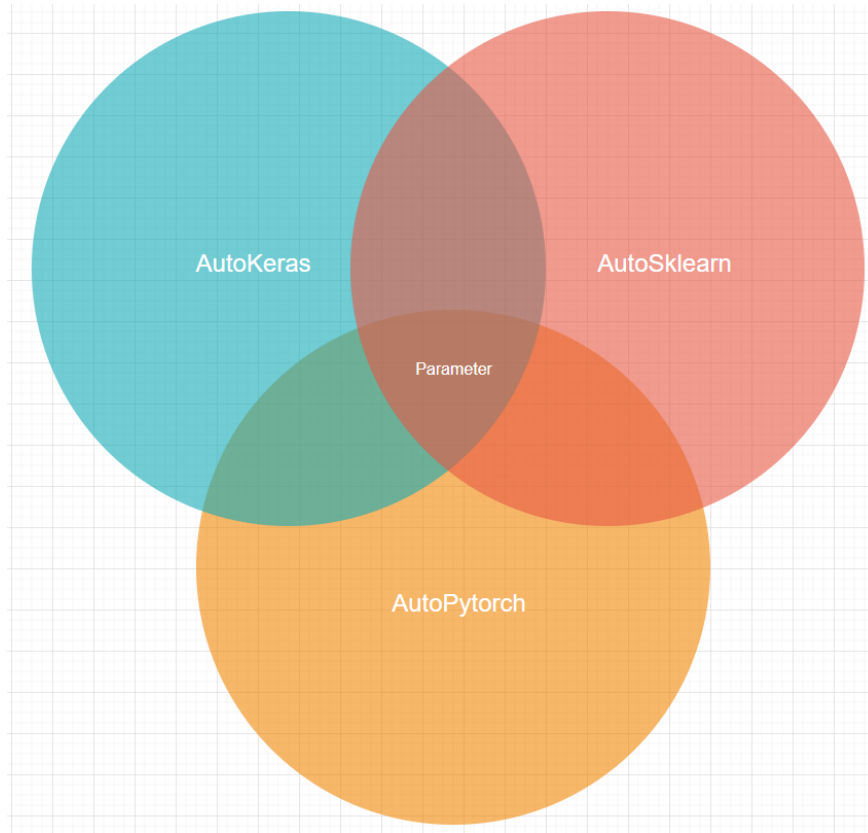
:ML_area a rdfs:Class ;
  skos:prefLabel "ML area" ;
  rdfs:comment "Broad category of ML, depending on the nature of the feedback";

:ML_task a rdfs:Class ;
  skos:prefLabel "ML task" ;
  rdfs:comment "Problem that is to be solved by ML, e.g., assign categories";

:ML_approach a rdfs:Class ;
  skos:prefLabel "ML approach" ;
  rdfs:comment "A set of technologies suitable for solving ML tasks, e.g., artificial neural networks";

:ML_prediction_performance_measure a rdfs:Class ;
  skos:prefLabel "ML prediction performance measure" ;
```

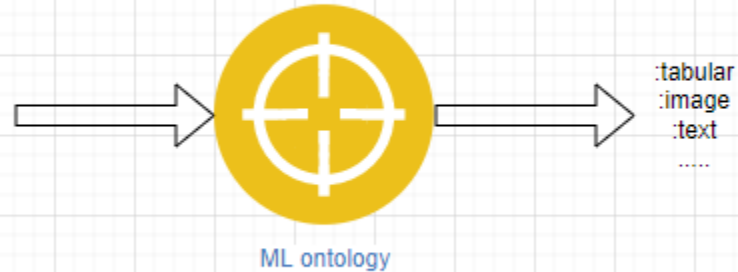






## ONTOLOGY BASED META AUTOML

```
ONTOLOGY_QUERY_GET_TASKS_FOR_DATASET_TYPE =  
  PREFIX : <http://h-da.de/ml-ontology/>  
  SELECT ?task  
  WHERE {  
    ?task a :ML_task ;  
    :has_dataset_type ?dataset_type ;  
    :supported_by_oma_ml "True".  
  }
```





Home

Datasets

Trainings

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## Dataset titanic\_train.csv

### Overview

Name: titanic\_train.csv  
Dataset type: Tabular

Date: 2022-10-13

File Size: 59.76 KB  
Number of rows: 891  
Number of columns: 12

### New Training

START TRAINING

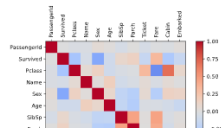
### Top 3 models

[MORE](#)

Name	Model	Library	Test score	Prediction time per sample	Total training time
Autosklearn	ensemble	Scikit-learn lib	0.91	5 ms	193 s
Autosklearn	ensemble	Scikit-learn lib	0.86	5 ms	197 s
Autosklearn	ensemble	Scikit-learn lib	0.85	5 ms	197 s

### Analysis

[MORE](#)



### Preview

[CONFIGURE](#)

PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ti
1	False	3	Braund, Mr. Owen Harris	male	22	1	0	A/ 21
			Cumings, Mrs. Jhn					

## “An Ontology-Based Concept for Meta AutoML” based Meta AutoML”

### An Ontology-Based Concept for Meta AutoML

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**Abstract.** Automated machine learning (AutoML) supports ML engineers and data scientists by automating tasks like model selection and hyperparameter optimization. A number of AutoML solutions have been developed, open-source and commercial. We propose a concept called *OMA-ML* (Ontology-based Meta AutoML) that combines the strengths of existing AutoML solutions by integrating them (meta AutoML). OMA-ML is based on a ML ontology that guides the meta AutoML process. It supports multiple user groups, with and without programming skills. By combining the strengths of AutoML solutions, it supports any number of ML tasks and ML libraries.

#### 1 Introduction

Machine learning (ML) is an important sub-domain of artificial intelligence (AI), allowing to make predictions using models based on previous observations [22]. Engineering ML applications for practical use requires sound experience of ML engineers respectively data scientists. Tasks to be performed include data analysis, data preparation, feature engineering, model selection, validation, learning curve analysis and hyperparameter optimization. To support data scientists and also enable domain experts to create ML pipelines, the field of *automated ML*

## “Ontology-

### Ontology-based Meta AutoML

Alexander Zender<sup>a,\*,\*</sup>, Bernhard G. Humm<sup>b,\*\*\*</sup>

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 E-mail: alexander.zender@h-da.de  
<sup>b</sup> Hochschule Darmstadt - University of Applied Sciences, Haardtring 100, 64295 Darmstadt, Germany  
 E-mail: bernhard.humm@h-da.de

**Abstract.** Automated machine learning (AutoML) supports ML engineers and data scientist by automating single tasks like model selection and hyperparameter optimization, automatically generating entire ML pipelines. This article presents a survey of 20 state-of-the-art AutoML solutions, open source and commercial. There is a wide range of functionalities, targeted user groups, support for ML libraries, and degrees of maturity. Depending on the AutoML solution, a user may be locked into one specific ML library technology or one product ecosystem. Additionally, the user might require some expertise in data science and programming for using the AutoML solution.

We propose a concept called *OMA-ML* (Ontology-based Meta AutoML) that combines the features of existing AutoML solutions by integrating them (Meta AutoML). OMA-ML can incorporate any AutoML solution allowing various user groups to generate ML pipelines with the ML library of choice. An ontology is the information backbone of OMA-ML. OMA-ML is being implemented as an open source solution with currently third-party ? AutoML solutions being integrated.

Keywords: Machine Learning, Ontology, AutoML, Meta AutoML, OMA-ML

#### 1. Introduction

Machine learning (ML) is an important sub-domain of artificial intelligence, allowing to make predictions using models based on previous observations [1]. ML is used as an approach to solve a multitude of prob-

leading to higher efficiency and, potentially, better results. More progressive AutoML solutions also perform data preparation, feature engineering and validation, allowing to create entire ML pipelines automatically [8] [9]. Currently, AutoML is focused on supervised ML [7]. There is a growing number of AutoML