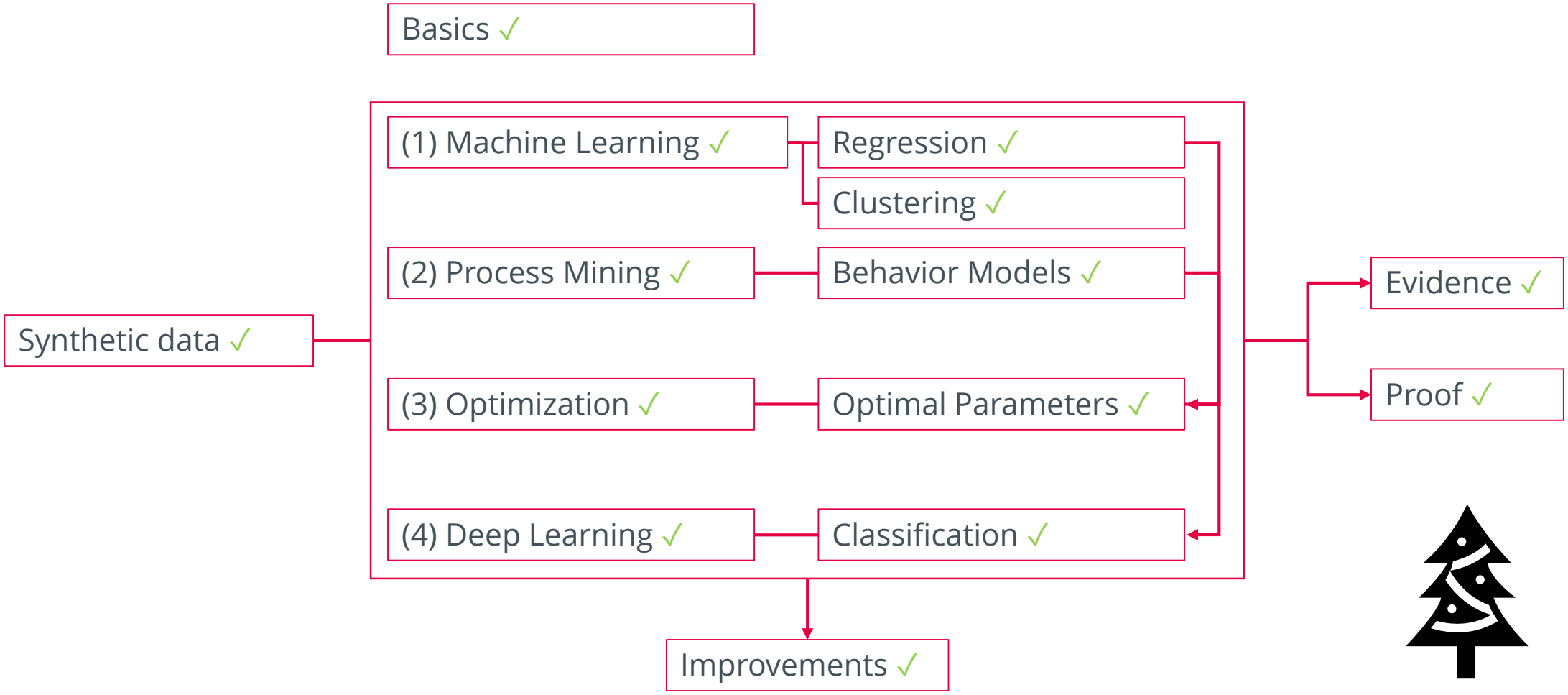
TECHNISCHE HOCHSCHULE
OSTWESTFALEN-LIPPE
UNIVERSITY OF
APPLIED SCIENCES
AND ARTS

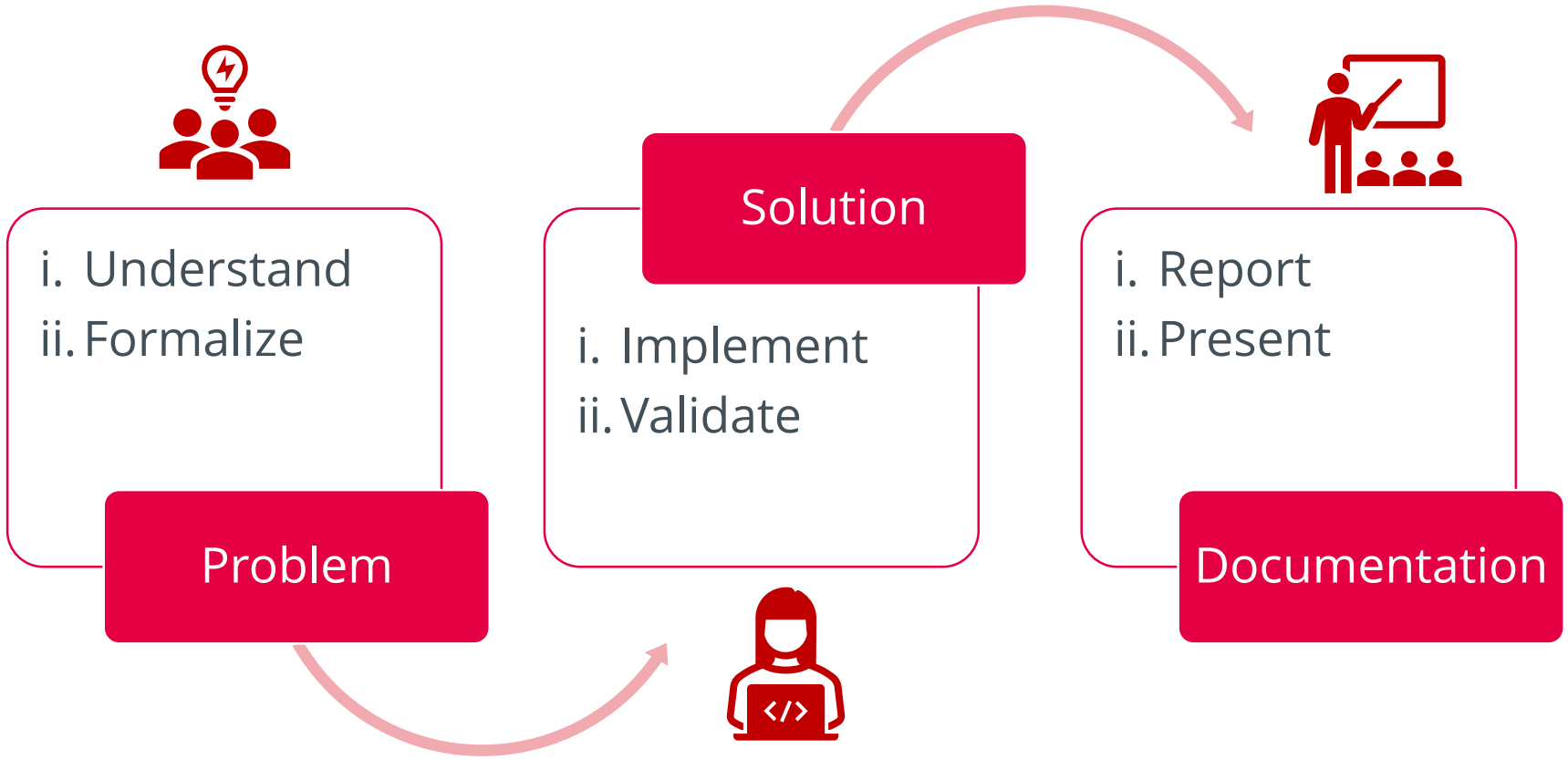
Welcome

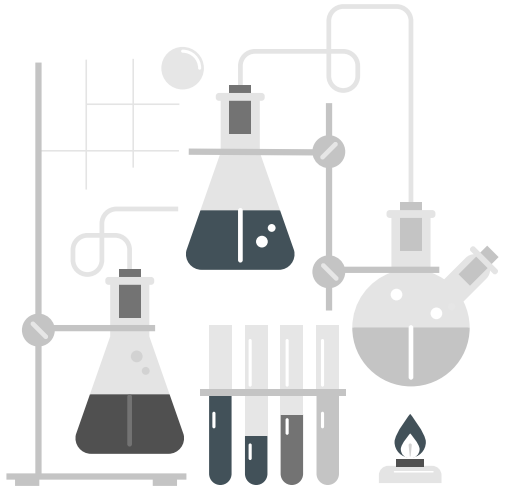
to Advanced Topics in Algorithms

Summary: Advanced Topics in Algorithms

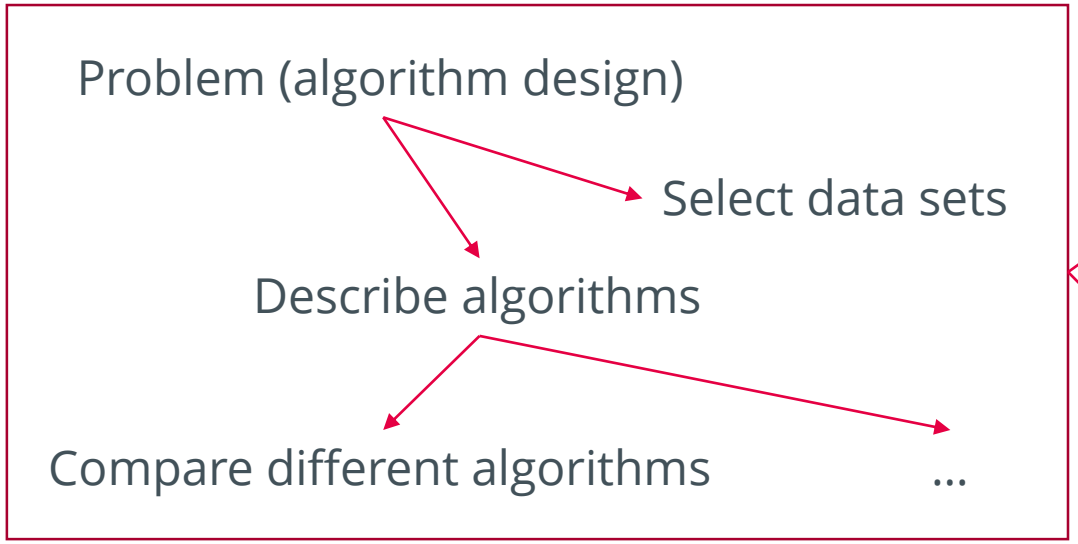


Learning Objective: Become a Scientist





Exam 2022



Report:

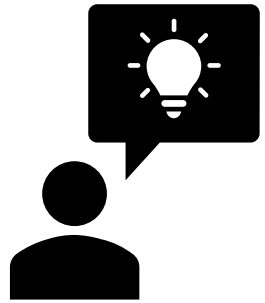
- 6 Pages double-column IEEE format
- Deadline 01/31/2022

Presentation with code review

- 02/04/2022 or
- 02/11/2022

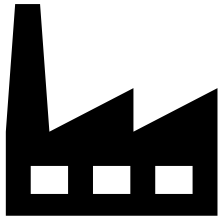
Section: Motivation

- **What is the problem? (create a figure)**
- **Why is it a problem?**
- **Why should the problem be solved?**
- **Why is the problem difficult to solve?**



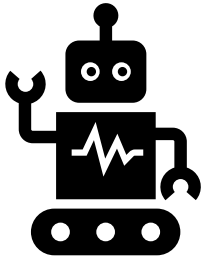
Cyber-physical Systems (CPS) are networks of software and hardware components controlling physical processes, i.e. time-dependent and concurrent processes.

Production Systems

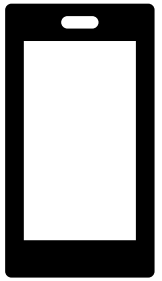


Self-driving car

Robotics

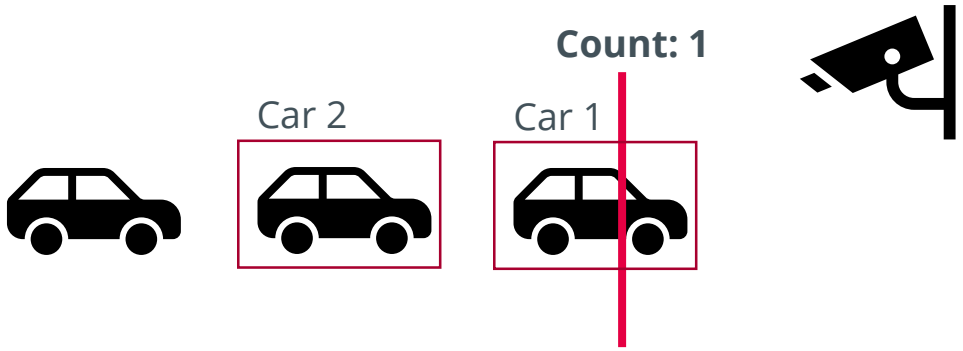


Smartphone

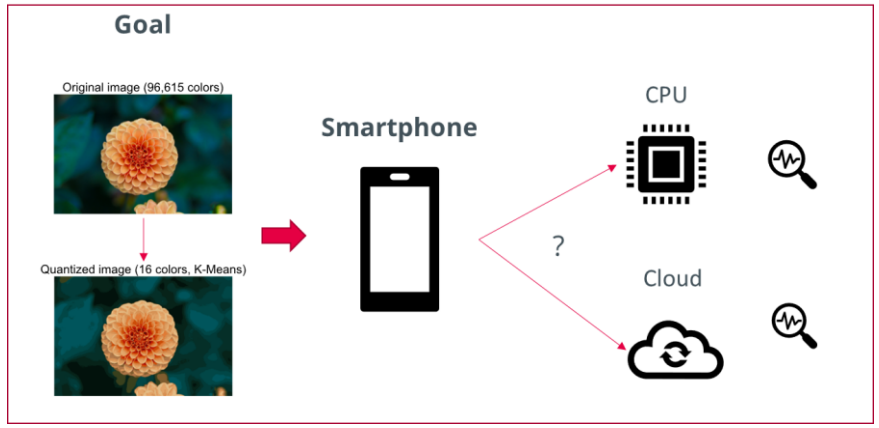


Section: Motivation

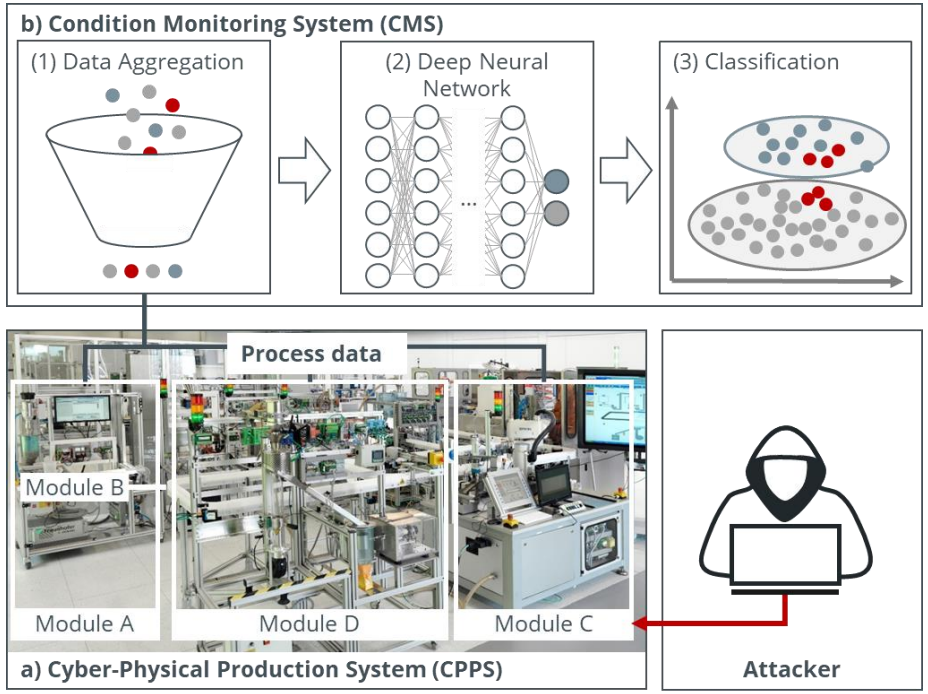
Vision



Optimization



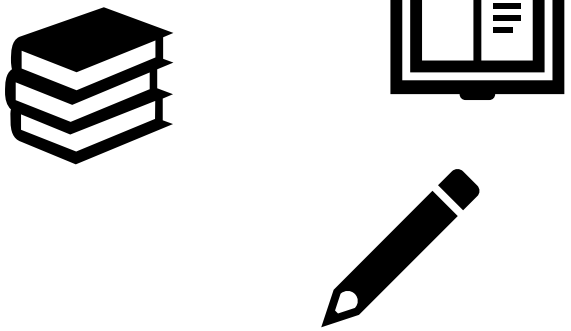
Condition Monitoring / Cyber Security



Section: State of the Art

- **At least 15 publications are to be cited!**
- **What solutions exist for the problem?**
- **How do the solution approaches work?**

=> https://scholar.google.com/

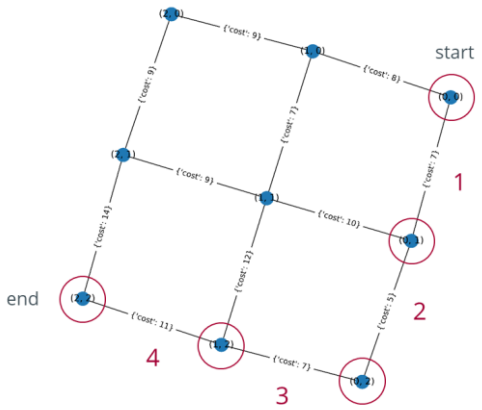


Publications

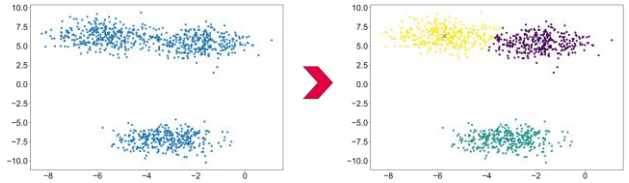
- Otto, Jens; Niggemann, Oliver: **Automatic Parameterization of Automation Software for Plug-and-Produce.** In: AAAI-15 Workshop on Algorithm Configuration (AlgoConf) Austin, Texas, USA, Jan 2015.
- Niggemann, Oliver; Henning, Steffen; Schriegel, Sebastian; Otto, Jens; Anis, Anas: **Models for Adaptable Automation Software - An Overview of Plug-and-Produce in Industrial Automation.** In: Modellbasierte Entwicklung eingebetteter Systeme (MBEES) S.: 73-82, Dagstuhl, Germany, Mar 2015.
- Otto, Jens; Vogel-Heuser, Birgit; Niggemann, Oliver: **Optimizing modular and reconfigurable cyber-physical production systems by determining parameters automatically.** In: IEEE 14th International Conference on Industrial Informatics (INDIN) S.: 1100-1105, Jul 2016
- Otto, Jens, Birgit Vogel-Heuser, and Oliver Niggemann: **Automatic parameter estimation for reusable software components of modular and reconfigurable cyber-physical production systems in the domain of discrete manufacturing.** In: IEEE Transactions on Industrial Informatics 14.1 (2018): 275-282.
- Otto, Jens; Vogel-Heuser, Birgit; Niggemann, Oliver: **Online Parameter Estimation for Cyber-Physical Production Systems.** In: at - Automatisierungstechnik at - Automatisierungstechnik, Aug 2018.
- ...

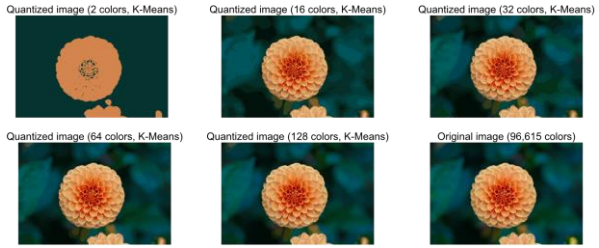
Section: State of the Art

A*



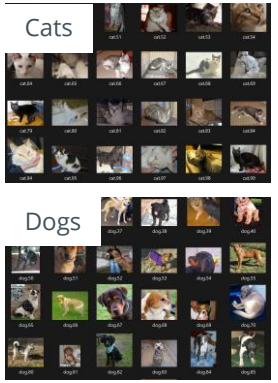
K Means





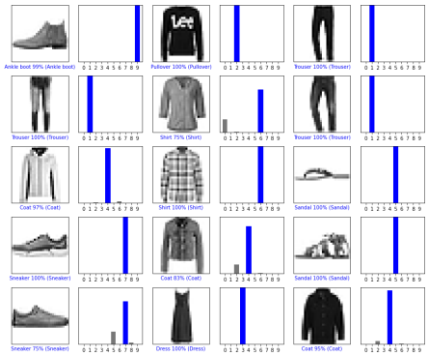
Classify Animals (Transfer Learning)

MobileNet V2 ImageNet



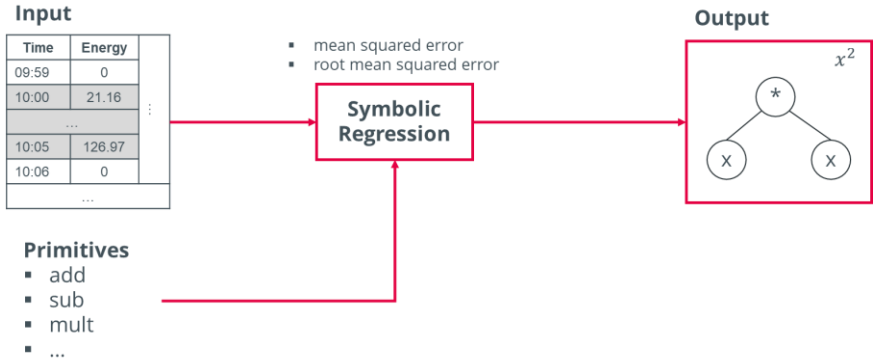
CDNet

Classify Clothes

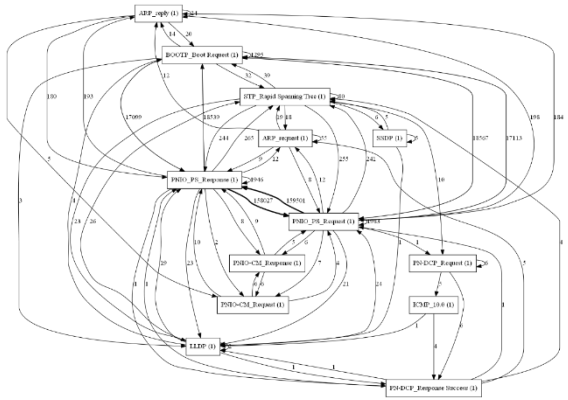


Section: State of the Art

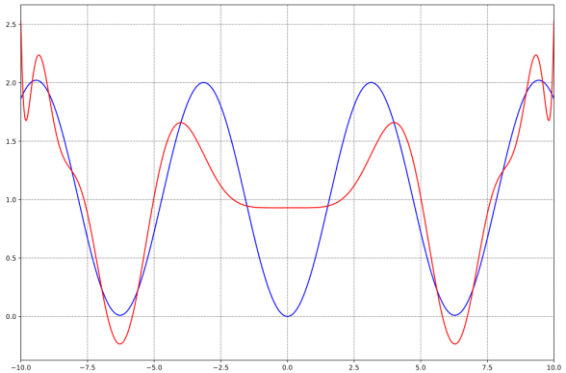
Symbolic Regression



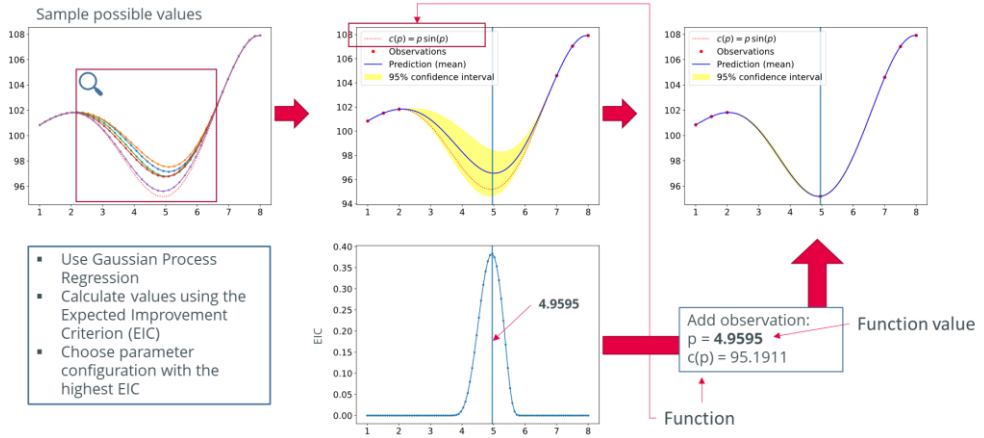
Process Mining



Regression with Polynomial Features

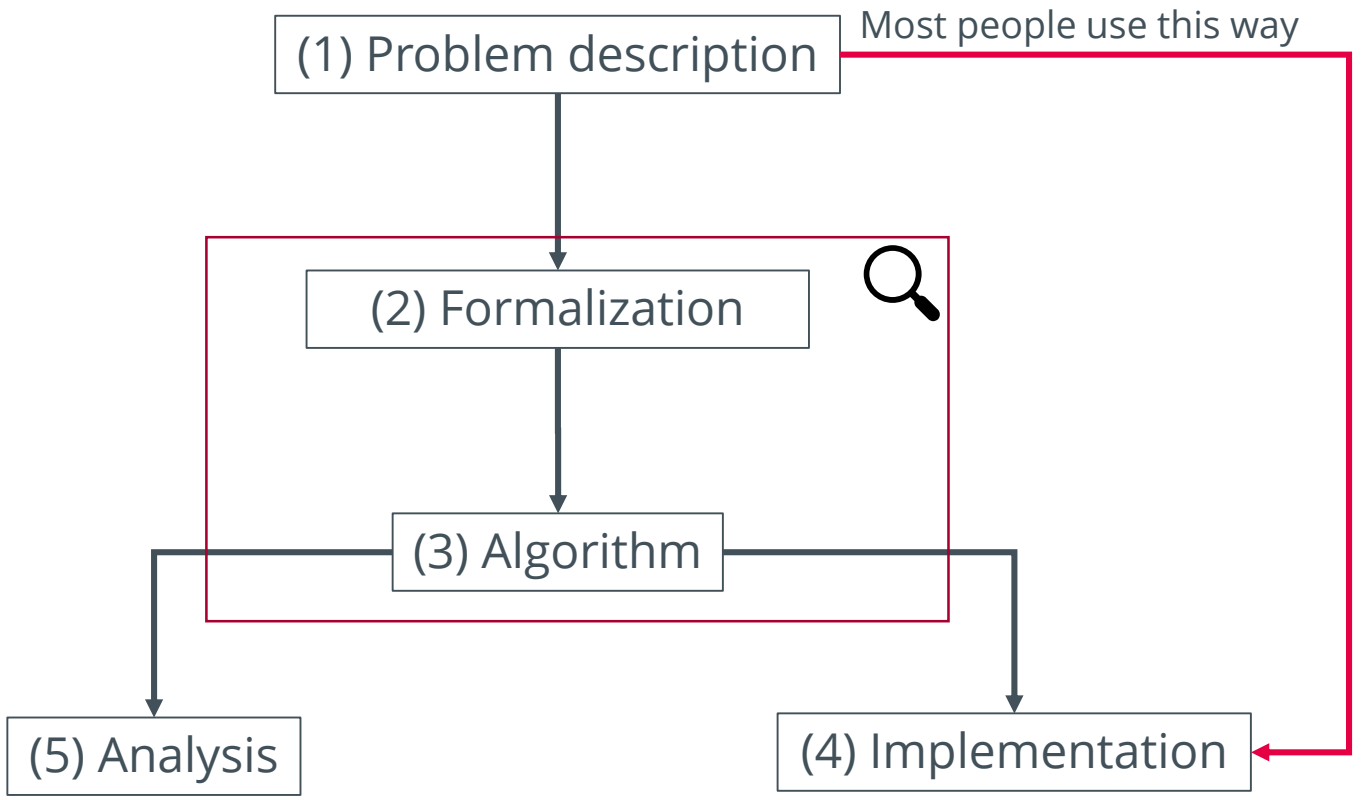


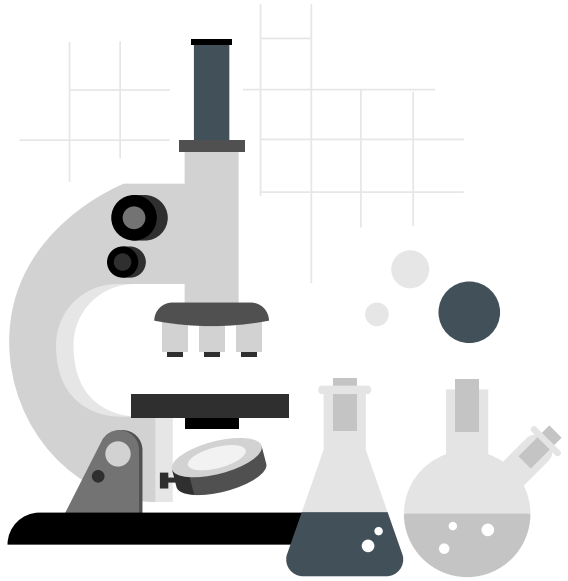
Gaussian Processes



Section: Solutions

- **Describe three solutions in detail!**



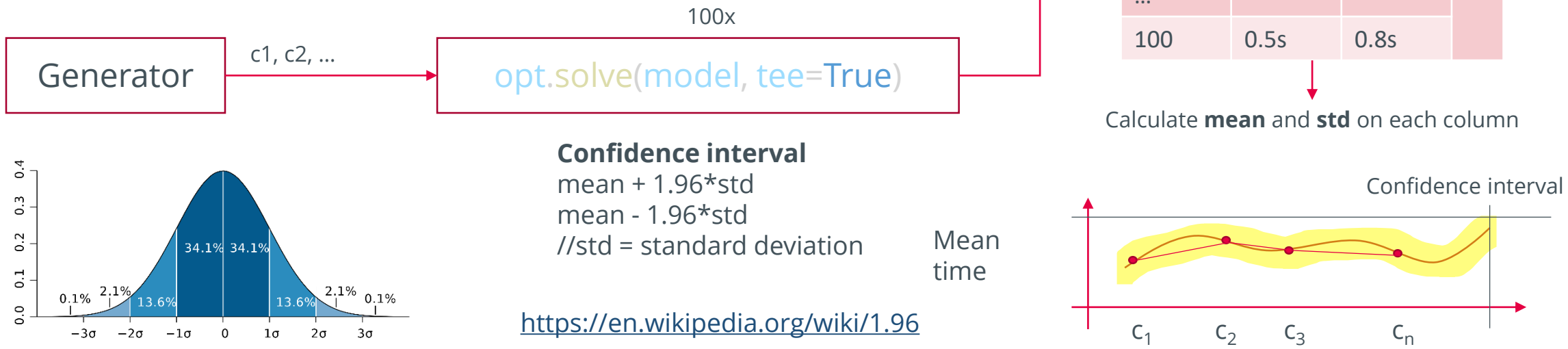


It's not rocket science

Section: Experiments and Results

Benchmark the Knapsack Problem
Open “Knapsack.py” and implement a generator for “v” and “w”. Increase items and measure the time to solve the problem. Repeat each benchmark (n-times) and calculate mean and variance time. Create a table and a plot to visualize your results.

https://realpython.com/python-timer/
https://docs.python.org/3/tutorial/datastructures.html#dictionaries
https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.mean.html
https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.std.html
https://en.wikipedia.org/wiki/Standard_deviation



Section: Summary and Outlook

- **What was treated?**
- **How well does the solution approach work?**
- **When does the solution approach not work well?**

Template

The XYZ Algorithm

John Doe

I. Motivation

TBD

II. State of the Art

TBD

III. Solutions

TBD

IV. Experiments and Results

TBD

V. Summary and Outlook

TBD

https://en.wikibooks.org/wiki/LaTeX

TH OWL

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Thank you!