Interactive Wiki for Special-Purpose Machines

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Presenter – Thomas Herpich

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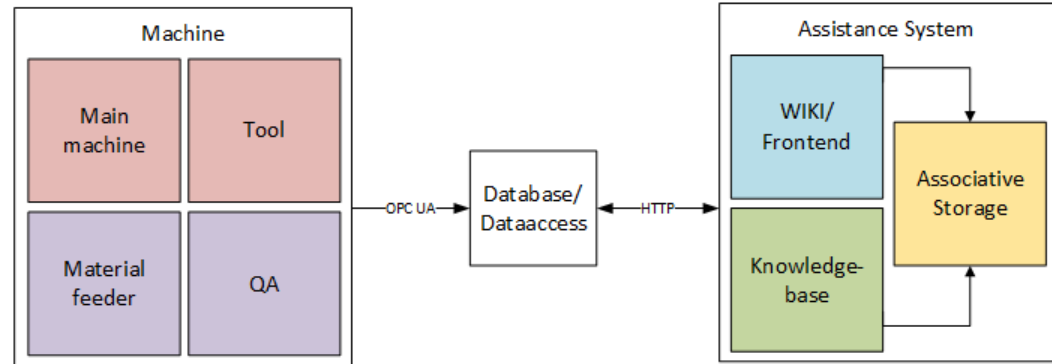- Research Group: Cyber-Physical Systems

Project Overview

- Collect data from multiple machines
- Create instructions for operators
- Map instructions to error situations
- Find appropiate instructions for new situations

System Structure
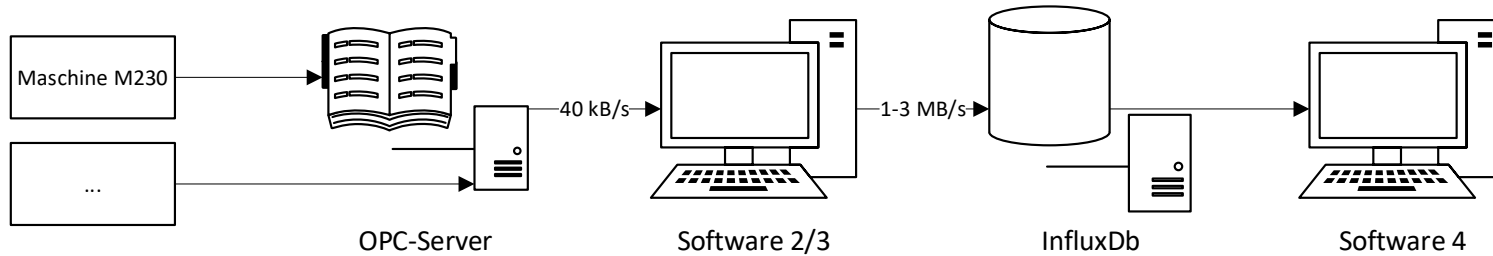
- Around 7500 Variables per machine
- Refresh interval: max. 10 ms

Data Analysis

- Build instructions from data
- Check: Data changes during fixing
- Result: No changes

time	Keep_Alive	Keep_Alive
20.09 19:15:42.54700000	-	-
20.09 19:15:54.79700000	true	true
20.09 19:15:55.75000000	**false**	**false**

MainWindow

| OPCGeneral	TotalCounter		OPCGeneral	PartsCounter1		OPCGeneral	PartsCounter2		OPCGeneral	ToolMonitoring.ToolStroke
513353	513357		513353	513357		513353	513357		42665396	42665400
OPCGeneral	ToolMonitoring.Pressforce		OPCGeneral	ToolMonitoring.Pressforce		OPCGeneral	ToolMonitoring.Pressforce		OPCGeneral	ToolMonitoring.Pressforce
301.75333	307.50745		839.3544	854.12866		569.96326	580.3275		1409.3176	1434.4562
OPCGeneral	ToolMonitoring.Pressforce		OPCGeneral	Ram.AnglePosition		OPCGeneral	Environment.OilPressure		OPCGeneral	Environment.OilTemperatu
[101.0,101.0,	[111.0,111.0,111.0,111.0,11		27.861328	324.3164		2.722591	2.7187762		37.4	37.5
Tool	Cyclecounter.Part2.ActualP		Tool	Cyclecounter.Part2.Actual		Tool	Cyclecounter.Total.ActualP		Tool	Cyclecounter.Total.Actual
513353	513357		513353	513357		513353	513357		513353	513357

New Assistance System
Interactive Wiki for Special-Purpose Machines

- Wiki based system:
  - Every user can create / edit pages
- Wiki page:
  - Description of the error
  - List of steps how to fix it (== Instructions)
  - Created by the operators
- Pages are mapped to situations

- System finds appropriate page for new errors
- Distinguish with all available data

New Wiki - Algorithm

- User Interface
- Knowledgebase
- Interaction and Classification
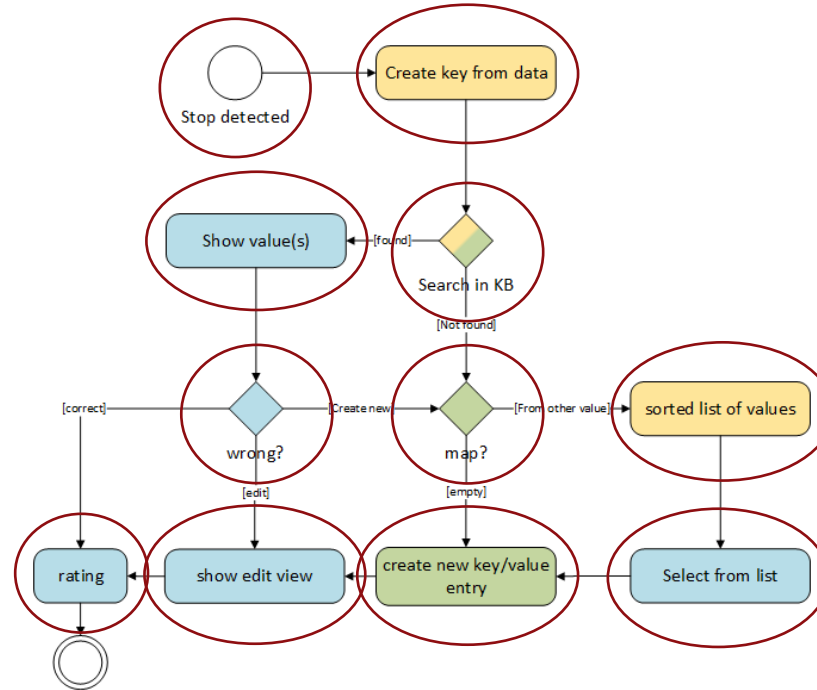
Knowledgebase – Classification

- KB: Mapping from previous situations to wiki pages

- Build a Machine Learing model from KB

- Use the model to classify new Data

- Comparison between data of situations:
    - Distance based
    - Decision tree

Decision tree – titanic
https://towardsdatascience.com/decision-trees-in-machinelearning-641b9c4e8052.
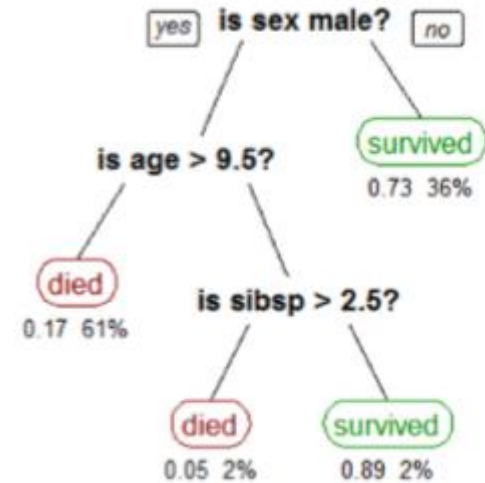
Classification – Random Forest

- Used in this software
- No feature selection
- Multiple decision trees
- Voting system

UI - Software

- Web application accessible from all PCs in the company
- JavaEE and Primefaces
    - Fast and reliable framework for prototyping
- Databases: MySQL and InfluxDB

UI – List of pages

UI – Create / Edit pages

Add Wiki-Page

Name:	Rüsten

Altes Werkzeug Ausbauen.

Neues Werkzeug Einbauen.

Desc.:

+ Create   **× Cancel**

Förderbandkontrolle Rotor 1 ausgelöst

1: Prüfen ob Schacht verstopft. - (Förderbandkontrolle Rotor 1 löst aus)

2: Wenn Endlospaket - Trennschieber prüfen. - (Förderbandkontrolle Rotor 1 löst aus)

3: Kabel auf verschleiß prüfen. - (Förderbandkontrolle Rotor 1 löst aus)

4: Bandanfang in Richtmaschine einführen - (Rollenwechsel)

+ Add step   **🖫 Save**   **× Cancel**   **⧉ Fill from template**

Add Step

Category:	Rollenwechsel
Step:	Bandanfang in Richtmaschine einführen

+ Add   **× Cancel**

UI – Main page

Results

- System runs 24/7 in full production
- Current data:
    - 6 Pages created
    - Mapped to 20 situations
    - Limiteded due to global pandemic
- Extended test scheduled in October 2020

- User experience: Different changes on request done
- Classification algorithm: no useful testresults until now

Thank you for your attention

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