Schweizerische Eidgenossenschaft
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The Data Innovation Project NOGAuto

NOGAuto By FSO

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Group of Experts on Business Registers
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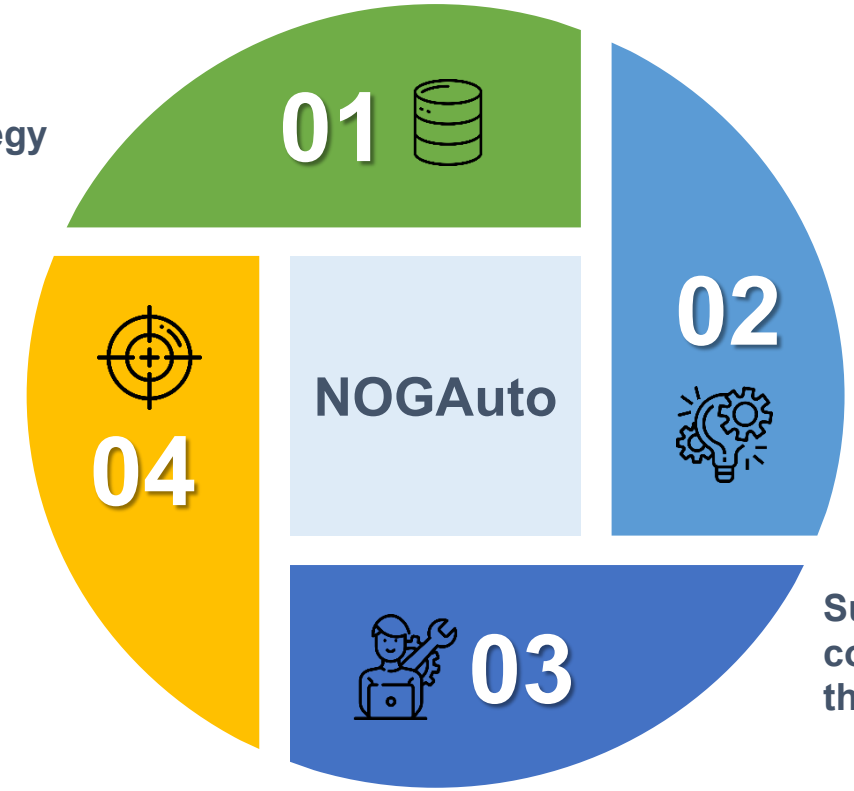
Agenda

1. **NOGAuto context and description**
2. **Today vs futur**
3. **Process**
4. **Measures of success**
5. **Workflow**
6. **Interface**

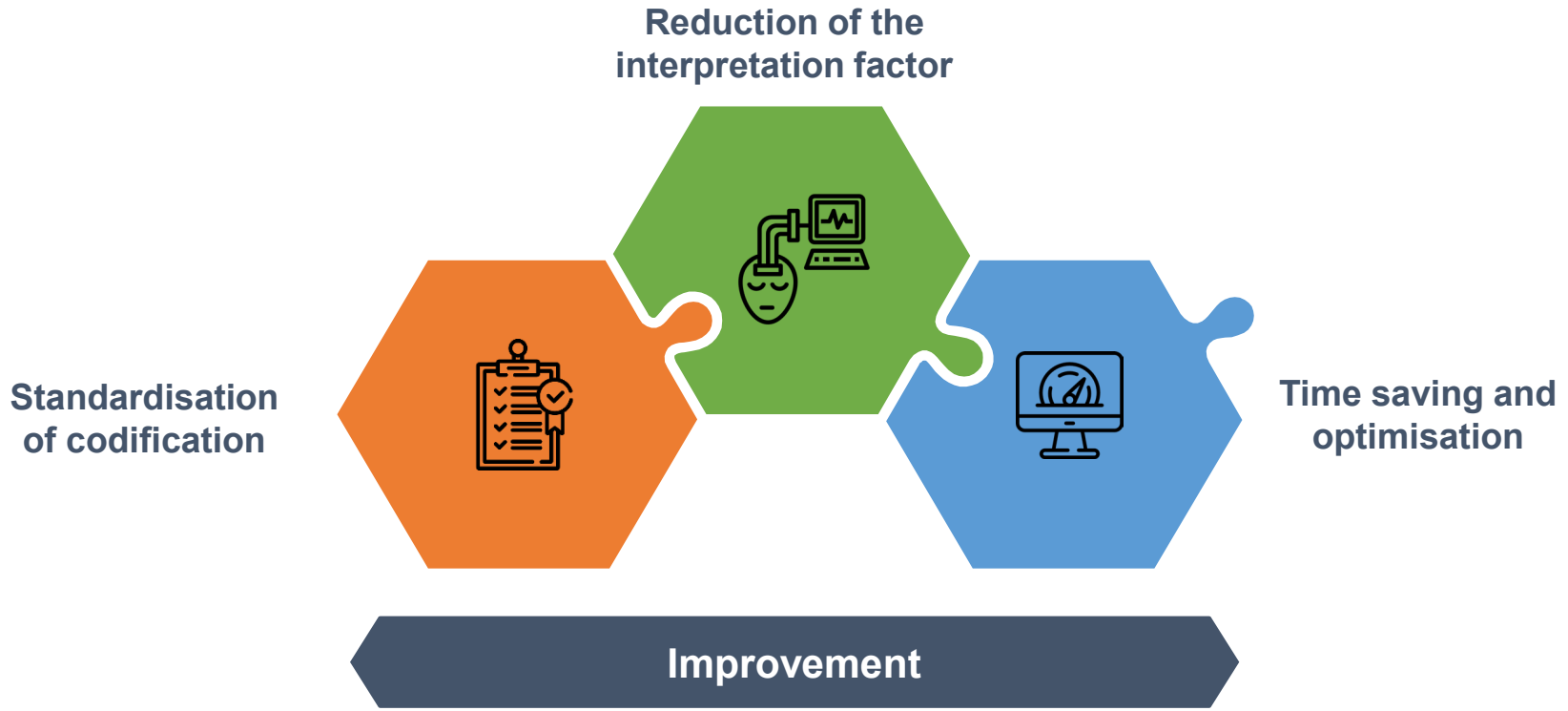
NOGAuto Context



Leading consequently to an overall quality improvement of all enterprise statistics.

Description of the NOGAuto project

The creation of a program that can automatically predict companies' NOGA codes using “Machine Learning” (ML) techniques with a coding quality that is equal or higher than the manual coding currently performed.



Today vs. Futur

Input: Activity description of a company

Coding

Quality control by sampling (~ 30%)

Processing of requests

Futur

Today

Input: Activity description of a company

Coding

NOGAuto

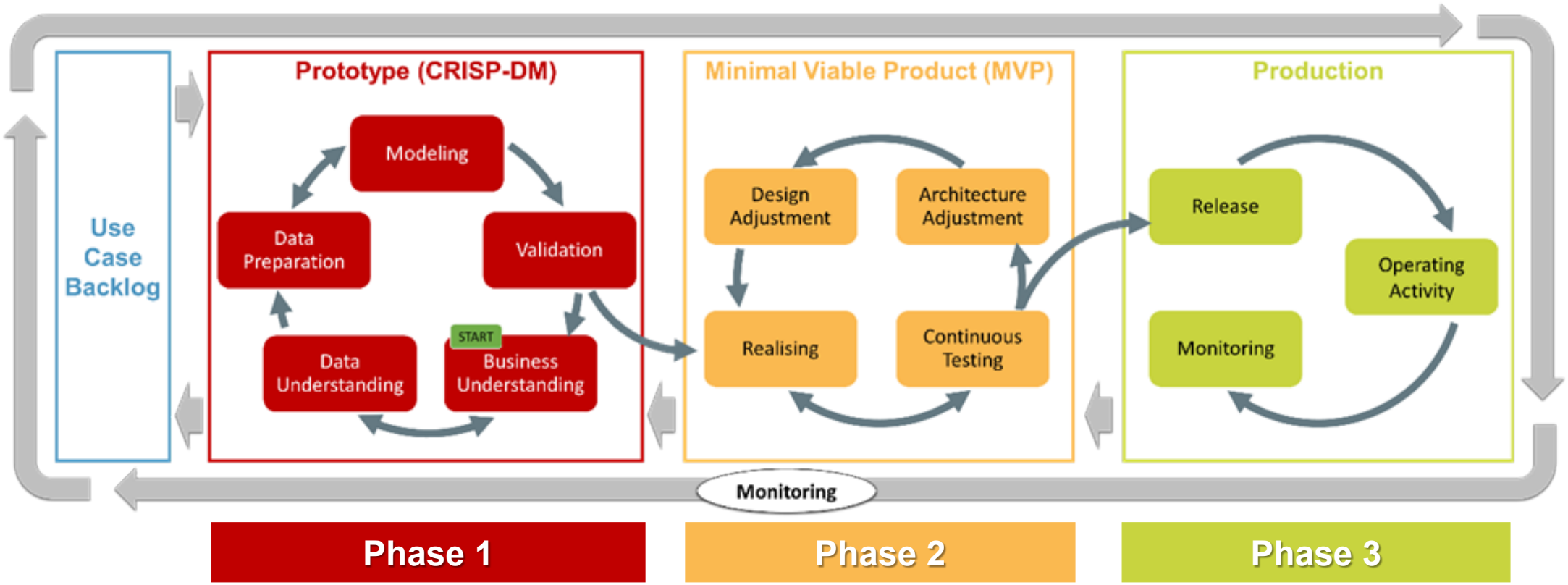
Quality control by sampling (~ 99.9%)

NOGAuto

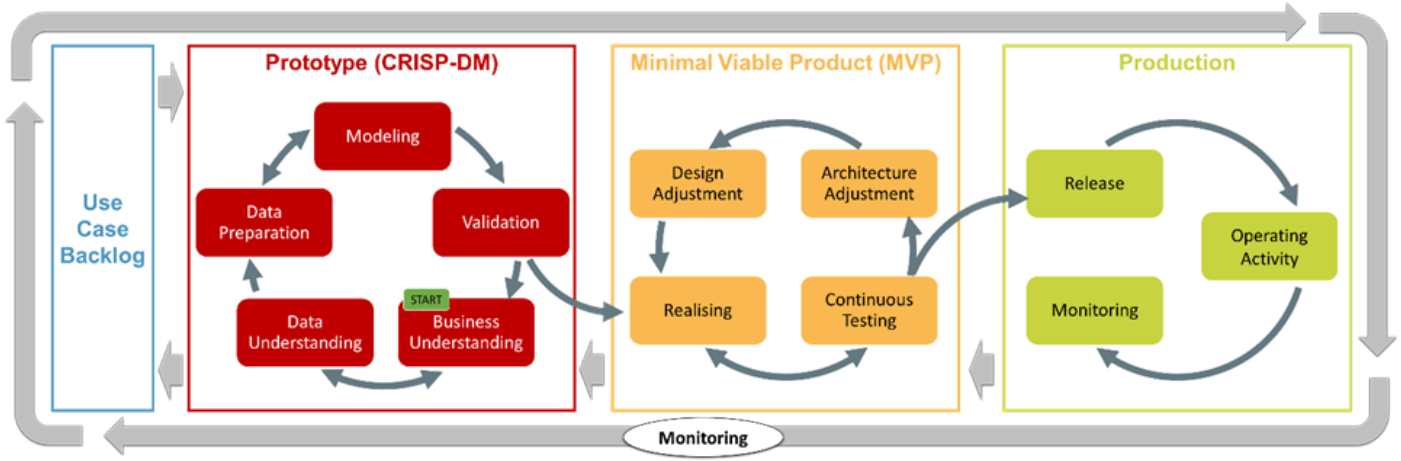
Processing of requests

NOGAuto

Data innovation as a process



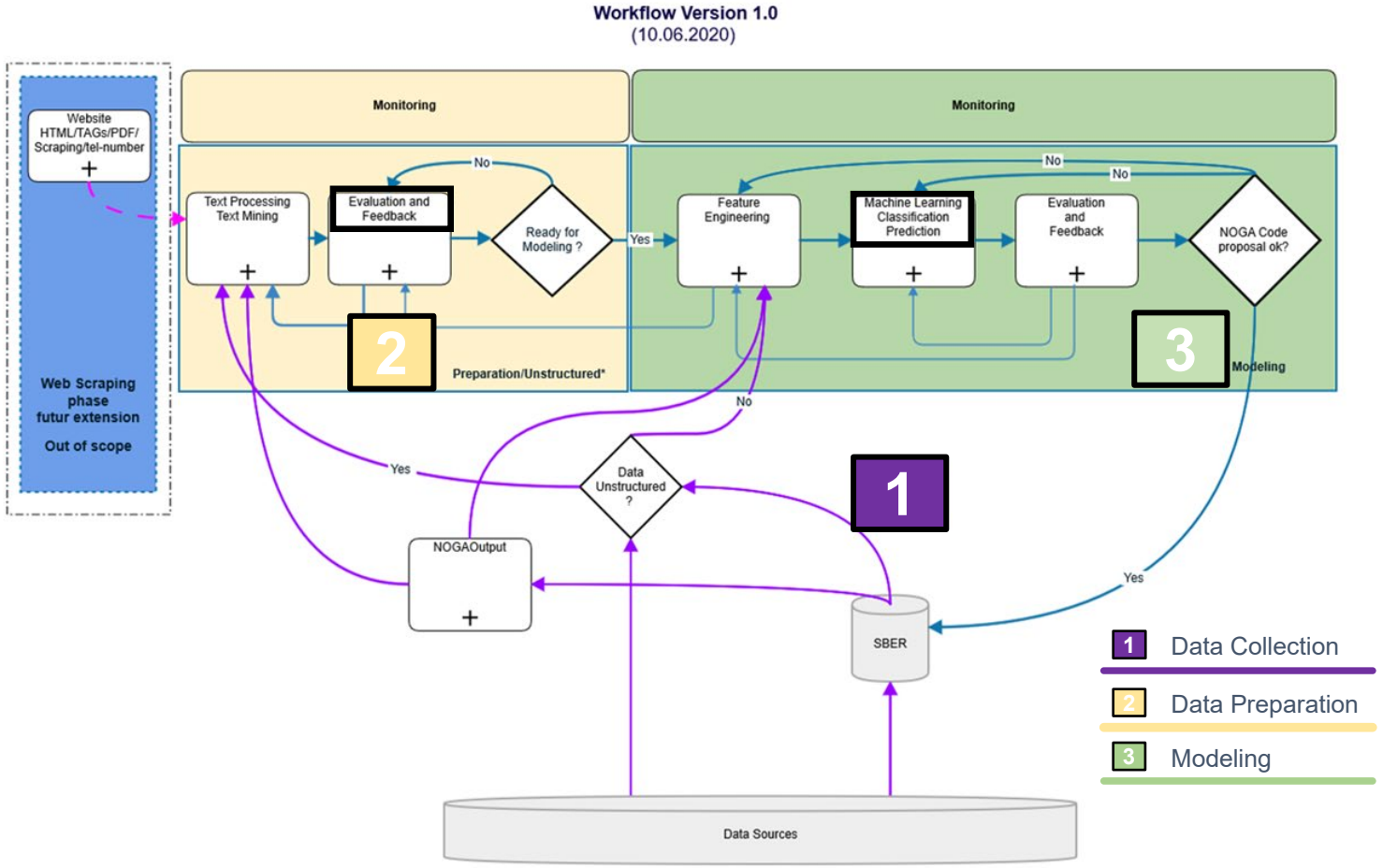
Measures of success



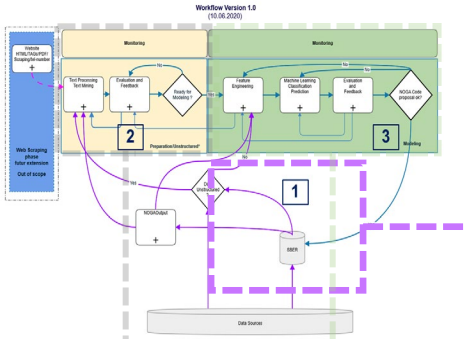
		Phase 1	Phase 2	Phase 3
Prediction ML system-centered	Predictive accuracy (1 – generalisation error)	**75 %**	**85 %**	**95 %**
	Documentation	✓	✓	✓
	Monitoring	✓	✓	✓
Domain user-centered	Interface		✓	✓
	Performance	✓	✓	✓
	Daily use		✓	✓
	Added value for the user	✓	✓	✓

Software used

Workflow of the «NOGAuto ML system»



NOGAuto Data Collection



1. Data Collection

- Internal Database
  - Business Enterprise Register BER (commercial registers, VAT, customer transactions (borders))
  - Over 1’000’000 observations with 56 variables each

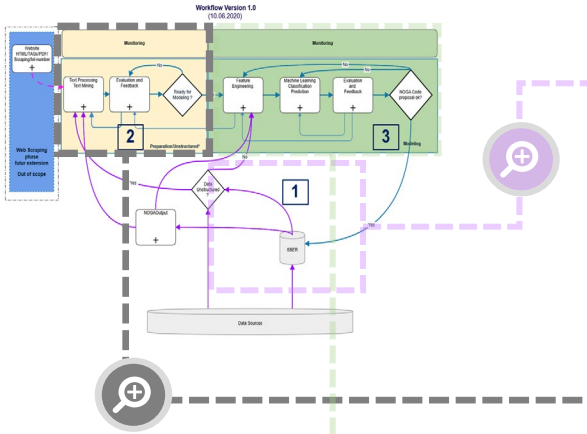
2. Data Preparation

- Language detection (e.g. naive Bayes, deep learning, N-gram, root cause analysis)
- Text mining & natural language processing (NLP) (e.g. one-hot encoding, Text2vec, Word2vec, t-SNE, word clouds)

3. Modeling

- GBM: Gradient Boosting Machine
- Three different models trained according to the language
- Cross-validation

NOGAuto Data Preparation



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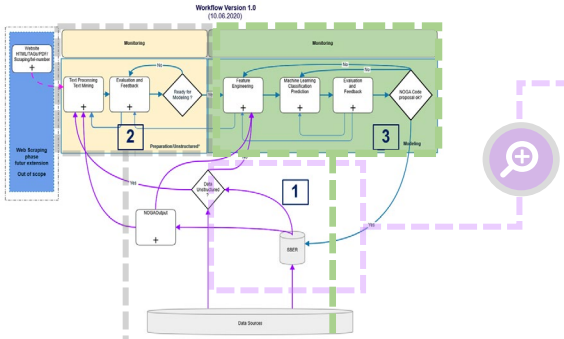
NOGAuto Data Modeling



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NOGAuto Modeling – 2 Digits predictions

2 Digits Prediction							
Real NOGA_2D	**1st Prediction**	**In %**	**2nd Prediction**	**In %**	**3rd Prediciton**	**In %**	**Match (=1) vs No Match(=0)**
01	**01**	99.395%	**03**	0.281%	**02**	0.114%	1
47	**47**	86.32%	**10**	8.718%	**46**	1.96%	1
96	**96**	99.87%	**47**	0.064%	**56**	0.014%	1
01	**86**	78.79%	**01**	19.602%	**47**	0.191%	1
86	**86**	41.00%	**74**	14.32%	**70**	13.70%	1
47	**47**	93.15%	**70**	3.717%	**96**	1.048%	1
49	**96**	16.37%	**49**	15.68%	**69**	7.51%	1
01	**01**	99.896%	**03**	0.037%	**96**	0.007%	1
01	**01**	99.988%	**03**	0.002%	**02**	0.001%	1
01	**01**	99.893%	**03**	0.035%	**86**	0.009%	1
01	**01**	99.366%	**03**	0.515%	**96**	0.013%	1
49	**49**	98.74%	**88**	0.387%	**85**	0.133%	1
85	**85**	85.35%	**90**	10.38%	**47**	1.044%	1
01	**01**	99.896%	**03**	0.037%	**96**	0.007%	1

Dataset	Predictive accuracy (top 3)
French	~ 99.12%
German	~ 96.16%
Italian	~ 98.25%

NOGAuto Modeling – 4 Digits predictions

4 Digits Prediction						
Real NOGA Code	**1st Prediction**	**In %**	**2nd Prediction**	**In %**	**3rd Prediction**	**In %**
8412	**8891**	53.85%	**8899**	7.112%	**8810**	4.48%
0143	**0143**	13.81%	**0150**	13.62%	**0121**	8.602%
8621	**8621**	24.05%	**8622**	19.03%	**8690**	4.455%
0141	**0141**	10.54%	**0150**	10.42%	**0121**	7.594%
8690	**8690**	52.246%	**9602**	5.707%	**9609**	5.373%
8621	**8621**	51.30%	**8622**	4.221%	**8559**	3.22%
0149	**0149**	31.91%	**0150**	14.55%	**0143**	1.639%
2341	**2341**	24.078%	**8552**	19.55%	**8559**	6.423%
0150	**0141**	19.24%	**0111**	7.834%	**0150**	6.713%
8622	**8621**	58.545%	**8622**	8.796%	**9900**	8.482%

Dataset	Predictive accuracy (top 3)
French	~ 88%
German	~ 40%
Italian	~ 95%

Example of activity descriptions

1 **FRENCH**

La société a pour but les conseils et formations en matière de finance, marketing et développement commercial; elle peut acquérir et administrer des participations dans d'autres entreprises ainsi qu'exercer des activités de support du management (pour but complet cf. statuts).

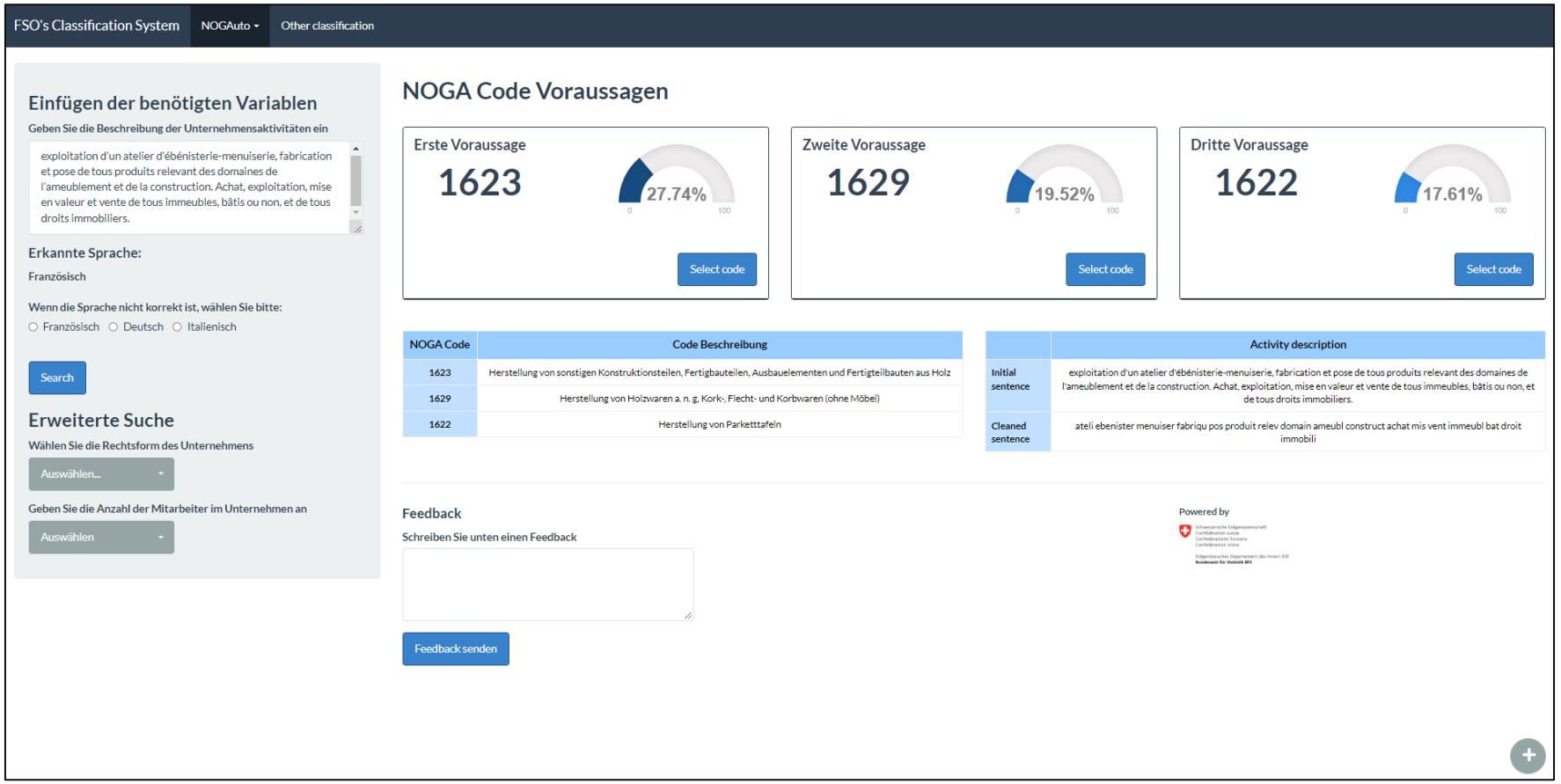
2 **GERMAN**

Ausführung aller Arbeiten im Fachgebiet Schreinerarbeiten, sowie den Handel mit Produkten der Holzindustrie.

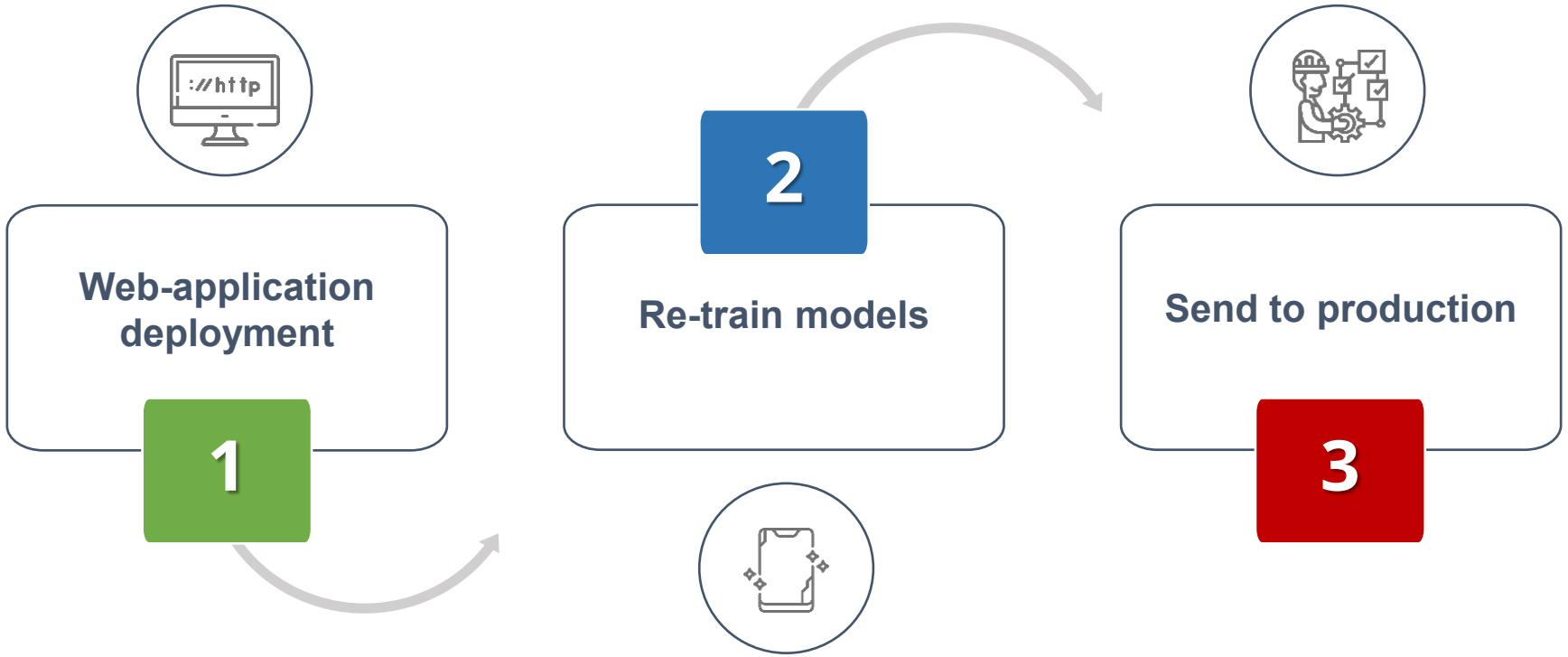
3 **ITALIAN**

La produzione e la vendita di vini e distillati, aceto e olio d'oliva sia in Svizzera che all'estero così come ogni altra attività atta a conseguire lo scopo sociale. La società potrà inoltre acquistare, vendere e amministrare beni immobili.

UI: User Interface



Next steps


://http
Web-application deployment
1
2
Re-train models
Send to production
3

Other potential deployment

NACE Revision (2024-2025)

- Potential supporting tool in the double codification for the collaborators for the complex cases namely companies with 1:n relations.
- The system will use only the observations of the dataset which are in the n categories and will train a ML model for the company being recoded.

Application on other nomenclatures

- Use the same methodology on different nomenclatures such as the profession ISCO nomenclature.
- First results are promising

Thank you for your attention
Questions?