

DATA SCIENCE TEAM

Excavation damages

Machine Learning as a Predictive Tool

Thomas Castelijns | Predictive Maintenance 2020 - Berlin

January 16, 2020



ENEXIS
NETBEHEER



About me



Background



- ◆ BSc. - Innovation Sciences ('09-12)
- ◆ MSc. - Sustainable Energy Techn. ('12-14)
- ◆ Post-MSc. - Data Science ('16-18)

Working experience



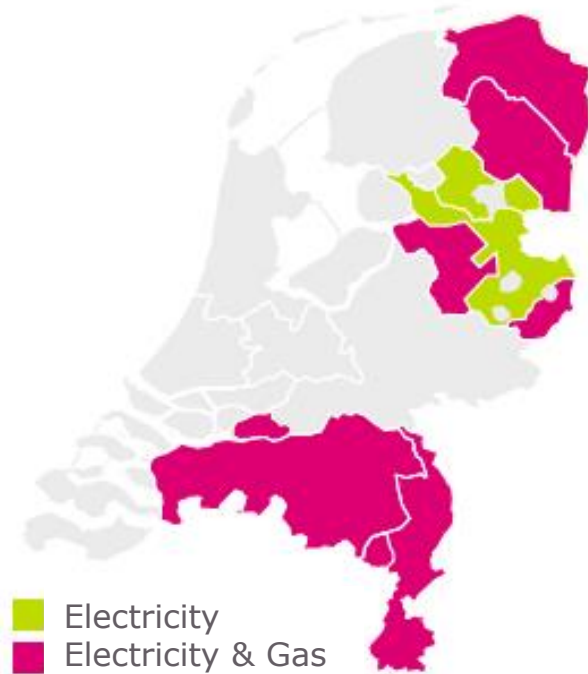
- ◆ Specialist in Smart Metering ('14-'17)
- ◆ Data Scientist ('18-now)







About Enexis



Distribution System Operator

◆ Regulated activities

- ◆ Installation
- ◆ Maintenance
- ◆ Development
- ◆ Management

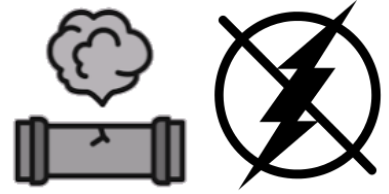
◆ Key facts

- ◆ ~ 4.5k employees
- ◆ ~ 2.7M customers
- ◆ Outage times
 - ◆ ~ 16 min Electricity
 - ◆ ~ 90 seconds Gas





Problem background



~250k



~6500

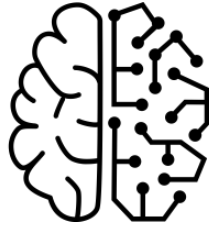
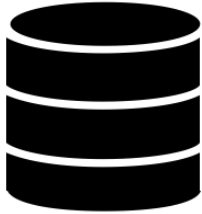




Main result of the project



Weekly predictions for prevention team for **efficient** precautions



Excavation activity ID	Probability	Feedback fields	Vulnerable objects
...797	0.775		School
...950	0.666		Office > 500
...905	0.659		Hospital, Kindergarten



Predictive features



Features

Excavation polygon shape

Excavation moment

Excavation activities

Excavation executor

Underground assets Enexis

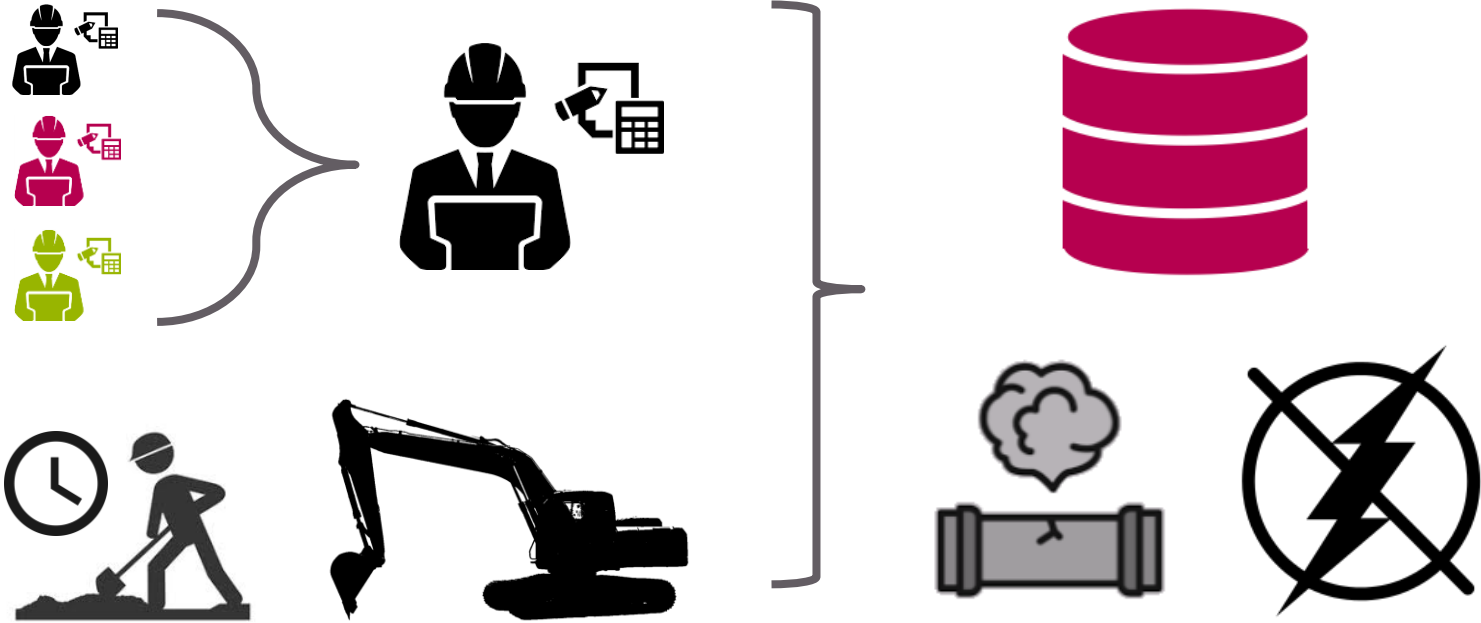
Labels

Excavation damages





Data Preparation: excavation activity datafields



Data Preparation: Polygon & Assets



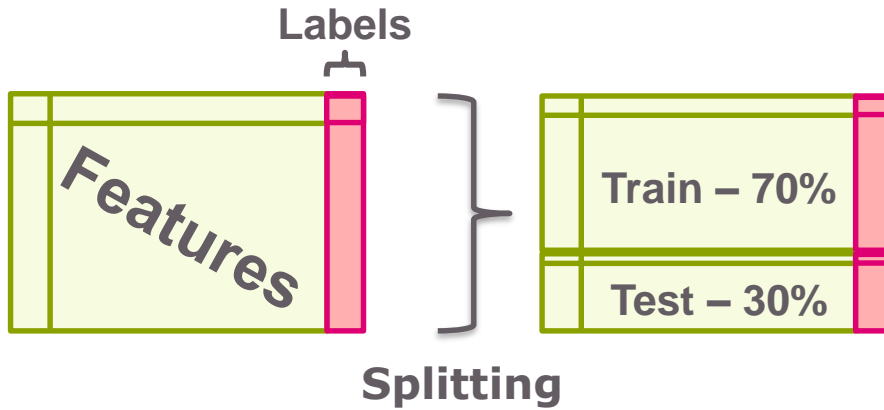
- ◆ Edges, perimeter, area, average length between edges etc.
- ◆ Lengths of assets
 - ◆ MV/LV
 - ◆ High/Low pressure
 - ◆ Per age category
 - ◆ Per material type



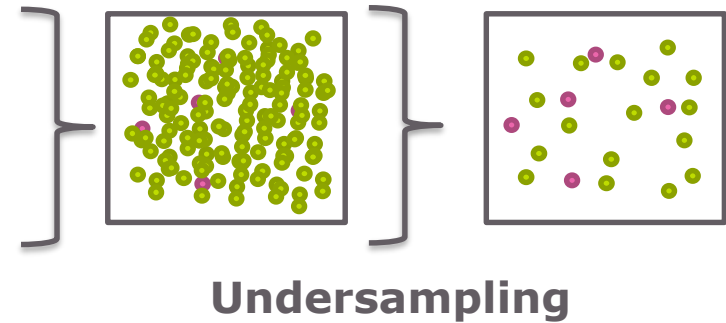


Modelling

Classification problem



Unbalanced data
0.8% in the trainset is a damage



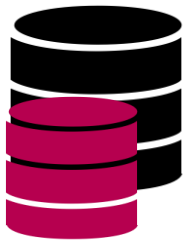
Evaluation metrics

- ◆ Precision
- ◆ Recall
- ◆ F1 - score

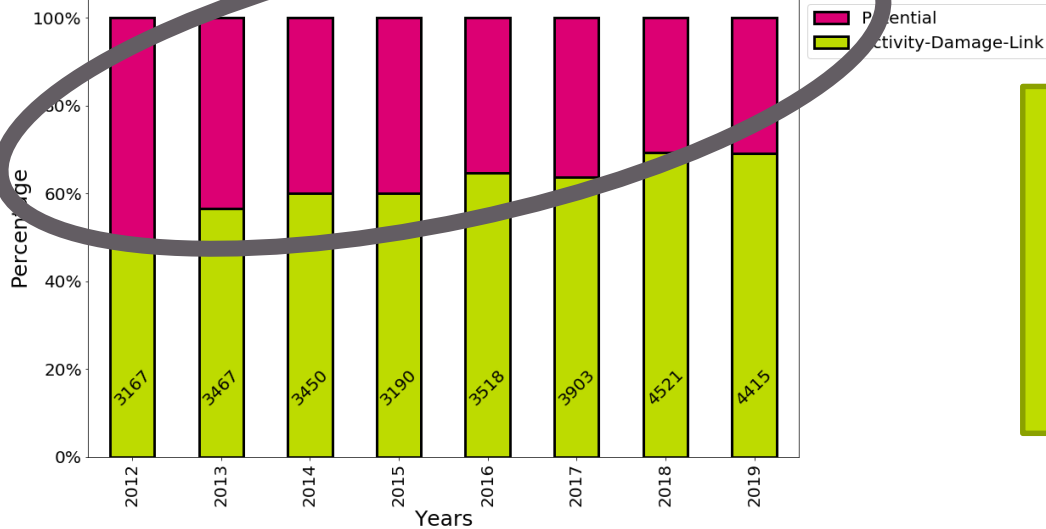




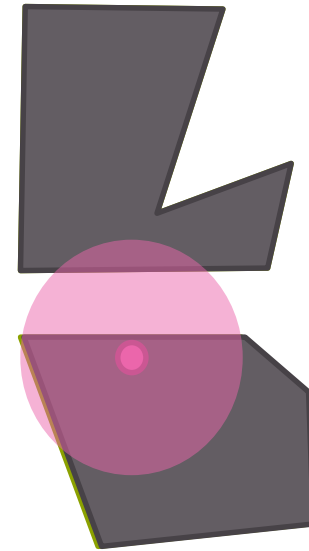
Data Preparation: Noise canceling



Data link between excavation activities and damages is improving



~ 6500 damages / year





Main result of the project

Recall = 29%, Precision = 22%

Suppose 6500 damages a year and we have an outdoor prevention team of 11 persons:

- ◆ *We predict 1890 damages*
- ◆ *We need ~ 8600 inspections*
- ◆ *~ 4 inspections per person a day*

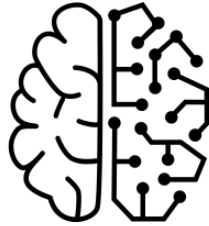
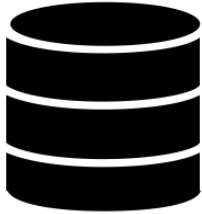




Main result of the project



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Future plans

- ◆ Evaluate results of prevention team of Enexis
- ◆ Improve data quality excavation work and damage databases
- ◆ Use other engineered features in classification model
 - ◆ Contractor vs. executor
 - ◆ Project complexity
- ◆ Deploy predictions in cloud with real time module in KLIC system
- ◆ Combine asset data pool with other underground utility companies
(Stedin/Brabant Water)





Any questions or
feedback?



Thomas.Castelijns@enexis.nl

