From big data to information:

How data scientists transform our utility with data driven algorithms

water voor nu en later

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DATA SCIENCE

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24/7 water for 1/3rd of The Netherlands

5,8 million inhabitants

1.394 employees

366,3 milion m3 pure drinking water/y

€1 for 1000 liters

8,3 customer satisfaction

no chlorine

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Overview Vitens data flows

2.5 mil customers → addresses, bills, customer contacts etc.

2500 smart meters and number is rapidly increasing

50.000 km of mains with topography, diameter, material, maintenance etc

Order flows for mechanics for maintenance etc.

>100 production locations, technical and operational data

>15.000 continuous data streams (granularity from 5 sec tot 1 day)

Chemical data (>10.000 grab samples households/y and at production locations)

At the beginning….. (my own intro at Vitens)

A new innovative type of water quality sensor was introduced

Laboratory testing showed perfect results

The sensors recorded an unexpected large number of alarms, and nobody understood why

The combination of unexpected readings in combination of TB’s of extra data resulted in the fist data scientist at Vitens (me)

After combination of domain experts and data analysis we found out that these sensors were very, very sensitive to pressure drops.

Side effects: we gained much more insight in water quality variations in our distribution network and the added value of data scientists

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Position data scientists at Vitens

Data scientists

Advanced data analists

Data analist

Information consumer

Raw data/
External data

Cleaned data

Preprocessed validated data

Interpreted data/ reports

About security and privacy

Almost data from sensors are sent to our own server (no cloud services) by land lines or secured 3G connections. Also, outgoing commands to actuators and regulation of pumps etc. are sent by secure lines.

Data from production environments can only be accessed by authorized employees with Vitens secured equipment (laptops, notepads, phones etc) and only changed by a very small number of authorized persons.

All under strict supervision of our security officers

Privacy sensitive data can be processed at a secure location (server) and only anonymized data may leave this server (under strict supervision of our privacy officer)

Scope data scientists

Automatized data cleaning

On-demand data research and building applications

Dashboarding (overlap with BI)

Optimizing distribution network

Automizing controlling distribution network (reinforcement learning)

Helping other company employees to work with our data to make Vitens a data driven company

Data cleaning

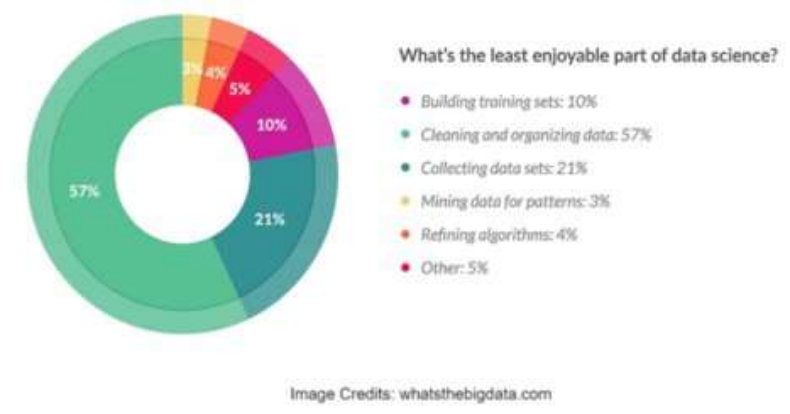

Image Credits: whatsthebigdata.com

Lots of existing applications fail or do show false positive warnings due to sensor failures or otherwise wrong data.

We use data science techniques to make them suitable for applications or further analysis.

"0.01% wrong values will lead to 10.000 false positive warnings"

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On-demand data analysis/research

Some examples

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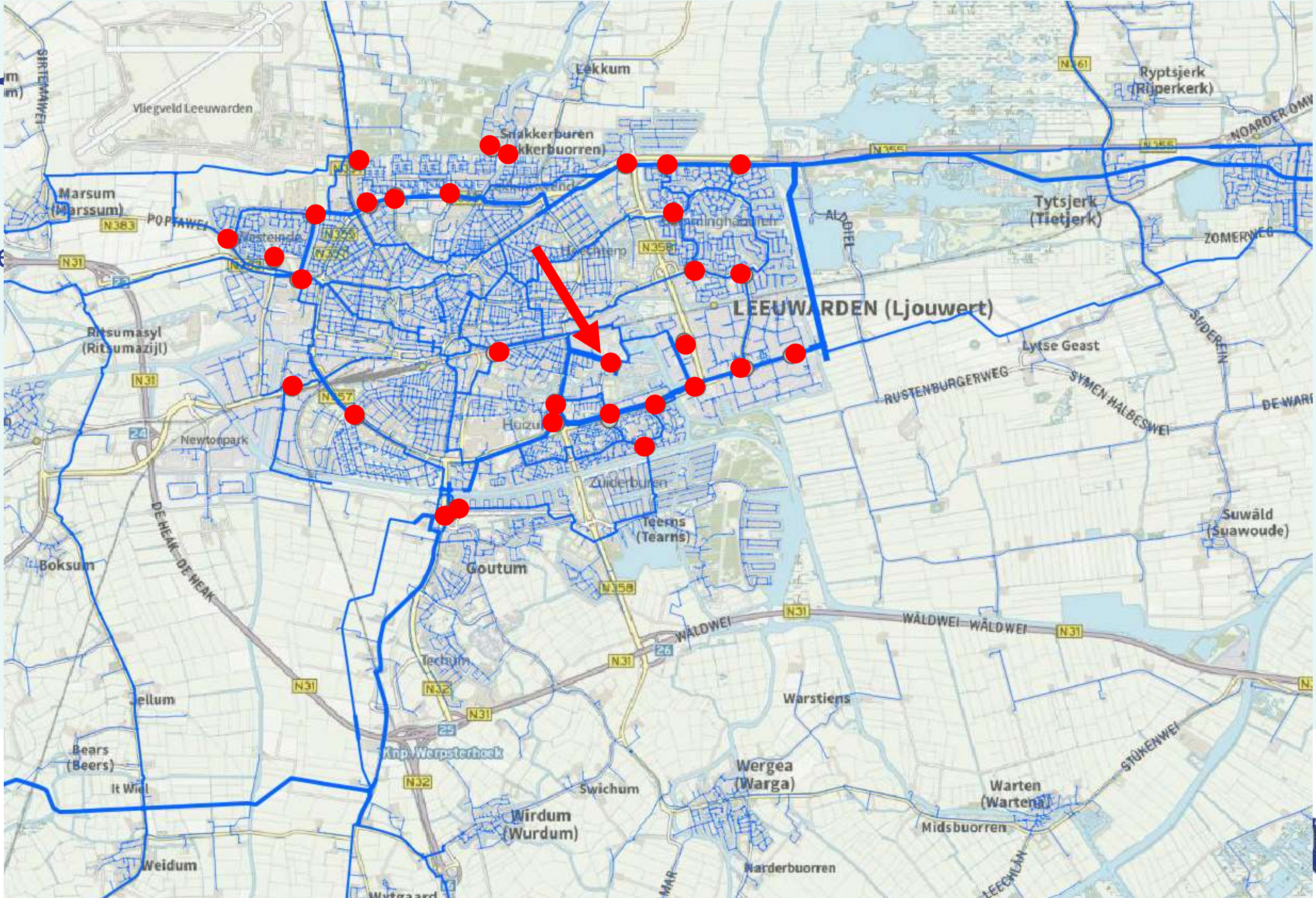

Lekkum
Vliegweld Leeuwarden
Snakkerburen
(Snakkerbuorren)
Ryptsjerk
(Rijperkerk)
NOARDER OMWEI
N355
N361
Marsum
(Marssum)
N383
POPTAWEI
Westeinde
Tytsjerk
(Tietjerk)
ALDDIEL
ZOMERWEG
N31
Hemrik
Camminghaburen
N358
LEEUWARDEN (Ljouwert)
Ritsumasyl
(Ritsumazijl)
Lytse Geast
SUDEREIN
RUSTENBURGERWEG
SYMEN HALBESWEI
DE WARF
N357
Newtonpark
Huizum
Zuiderburen
Teerns
(Tearns)
Suwâld
(Suawoude)
Boksum
DE HEAK
Goutum
WALDWEI
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(Warga)
Warten
(Wartena)
STÛKENWEI
Wirdum
(Wurdum)
Midsbuorren
Weidum
Harderbuorren
Wytgaard

Travel times measured by EC meters

650
630
610
590
570
550
530
510
490
470
450

25 January 2021 26 January 2021 27 January 2021 28 January 2021 29 January 2021 30 January 2021 31 January 2021 01 February 2021 02 February 2021

Incoming water (MLKA)
EC meter 80520027
EC meter 80520029
EC meter 80499905

Search for lead pipes

Lead pipes lead tot elevated lead concentration in water and are relatively old and not digitally stored

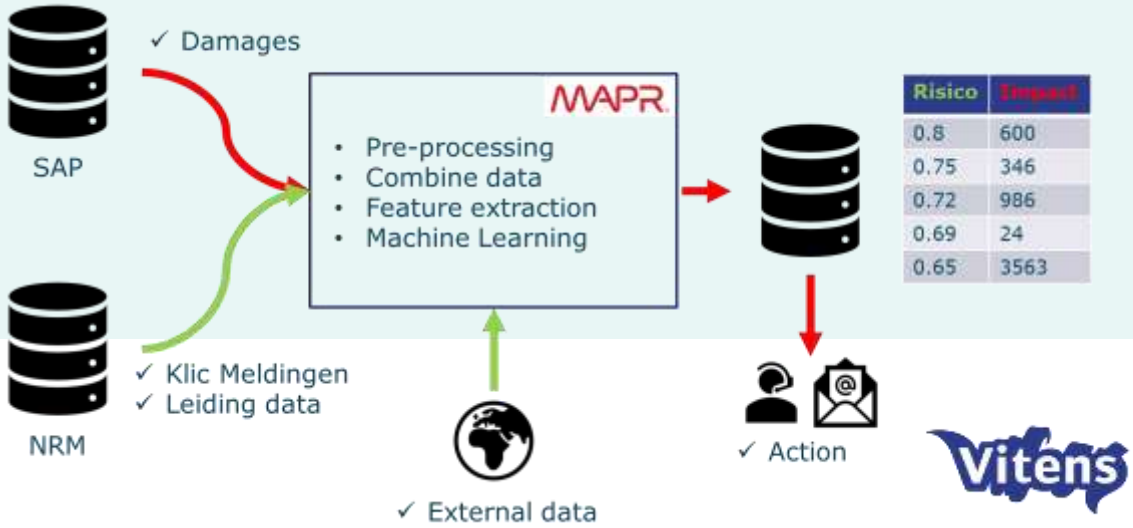
However…. We still do have ancient drawings

Information about lead pipes can be derived from an enormous amount of drawings

Damage by third party contactors

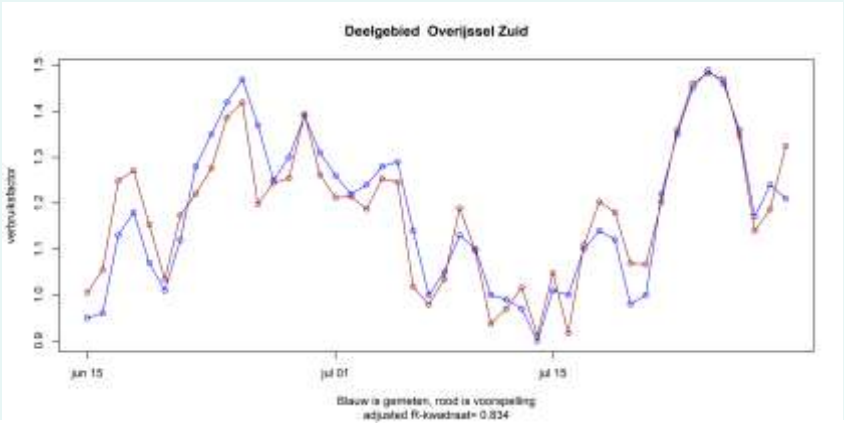
Yearly about 100 mil Euro damage is done by third party contractors

After collecting data such as contractor, kind of activities, complexity, soil type etc. we built a machine learning model that calculates the chance of damage to water mains so we can act at the start of the activities



Estimation of water consumtion, short and long term

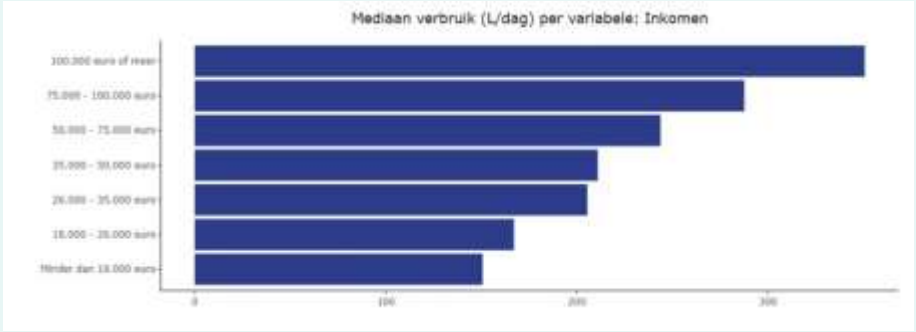
Daily pestimation water use during heat wave based on weather forcast

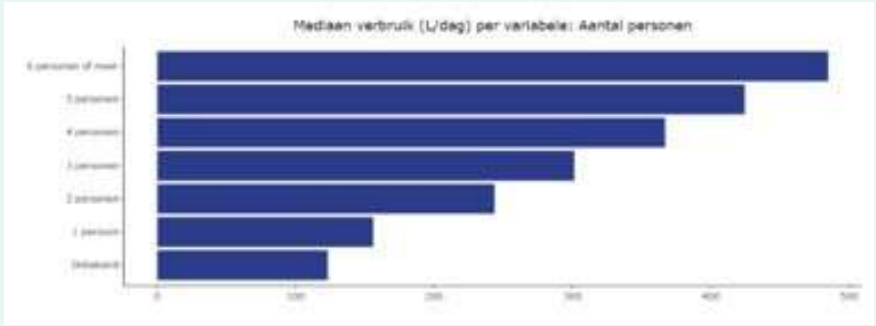


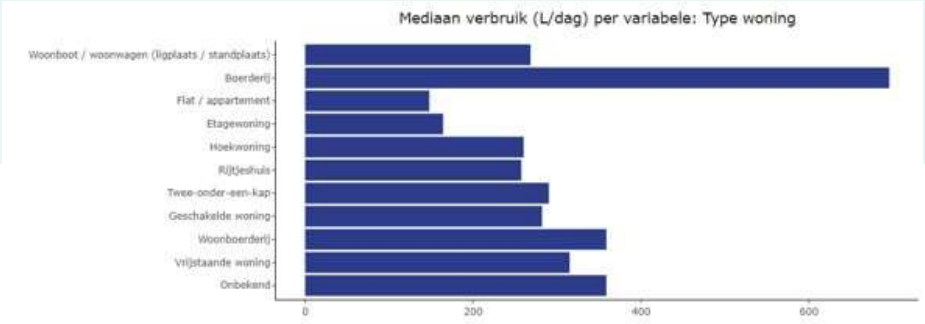
Long term propability estimation yearly water use based on population growth, economic growth and climate change

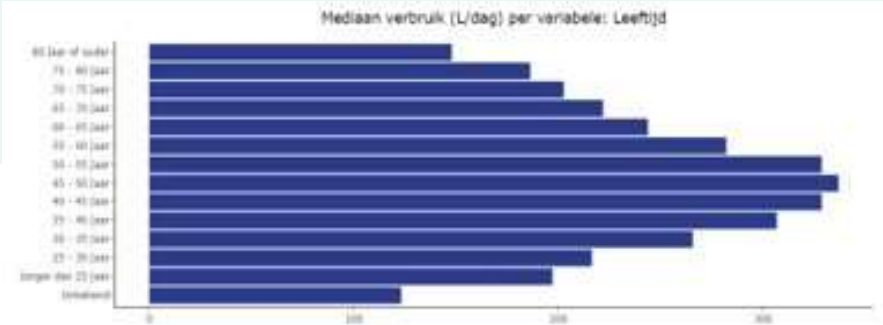
Customer analysis

Combination of household water bills or smart meters and household properties









Optimizing network performance

Recent → development of digital twins and beyond: reinforcement learning for optimizing operation instead of calculating man-made scenario's

examples: production plants and parts distribution system

Our systems are getting so complicated that a person can not have a complete overview combined with the outflow of experienced employees due to retirement

Our final target: making better decisions with smart algorithms than man can do

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Cooperating parties

ANCHORMEN
a Quint company

Royal HaskoningDHV
Enhancing Society Together

rijksuniversiteit groningen

KWR

Deltares

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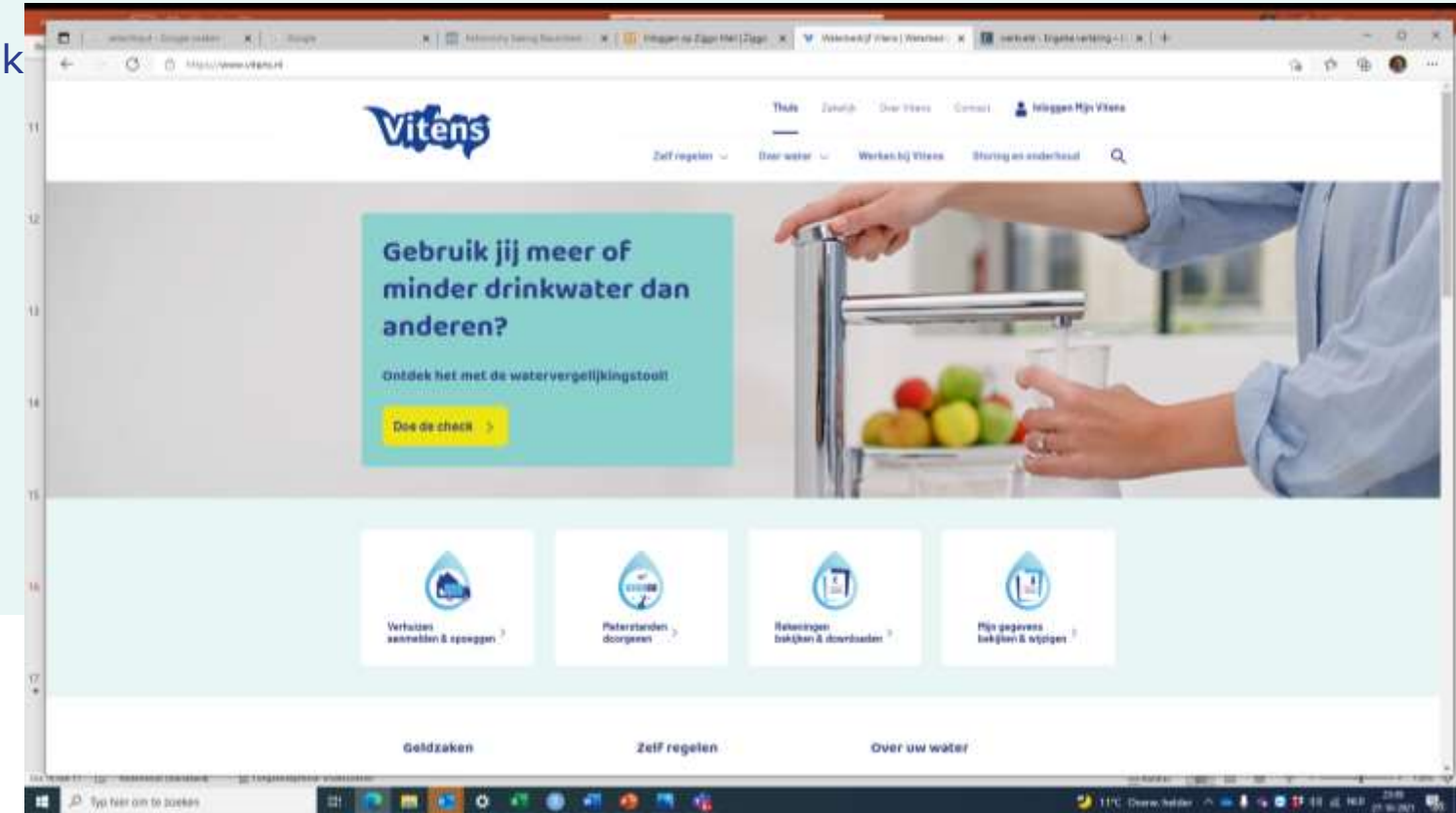
So, how we did transform our utility?

First: have a look



So, how we did transform our utility?

More awareness that data quality is a key value, even for ongoing operation giving priority to data cleaning

We can use data science for very complex analysis not possible before with all kinds of data

We did build applications to improve the transformation from data to information, available for everyone

For policy makers we did give information for (near) future water demands

We are convinced that algorithms eventually will help and improve our network performance, better than we do now.

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water

voor nu

en later

www.vitens.nl

Questions?

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More Information

For info or further questions on this webinar please contact the JASPERS Networking Platform team:

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