



BOLTZMANN

— machine learning —

Boltzmann

- Founded in 2017 by AI specialists
- Team of 15 incl. 2 professors, 6 PhDs, professional developers & accountants
- Activities:
 - Large clients in consulting (banks, energy, industry, ...)
 - **Ludwig Assistant**, the AI assistant for accountants. First pilot customers in 2018, now more than 15.000 companies



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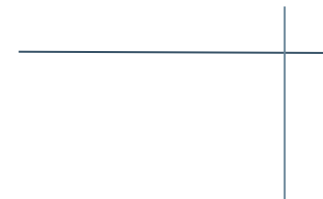


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— machine learning —

Projects





SOME OF OUR WORK

Fraud detection, AML,
Invoice mgt prediction
@ Finance

Predictive Maintenance,
Utilities prediction
@ Energy

Contract clauses,
Patents discovery,
Product categorisation
@Data platforms, Retail

Cold start recommender
@ Immo

Wage benchmark
@ HR

• **LEDWIG**
@ Accountancy

We build
MACHINE LEARNING
applications for the
CORE PROCESSES
of your company

1

Co-discover and **IDENTIFY**
the best ML application

2

TOGETHER develop a
tracer-bullet MVP


3

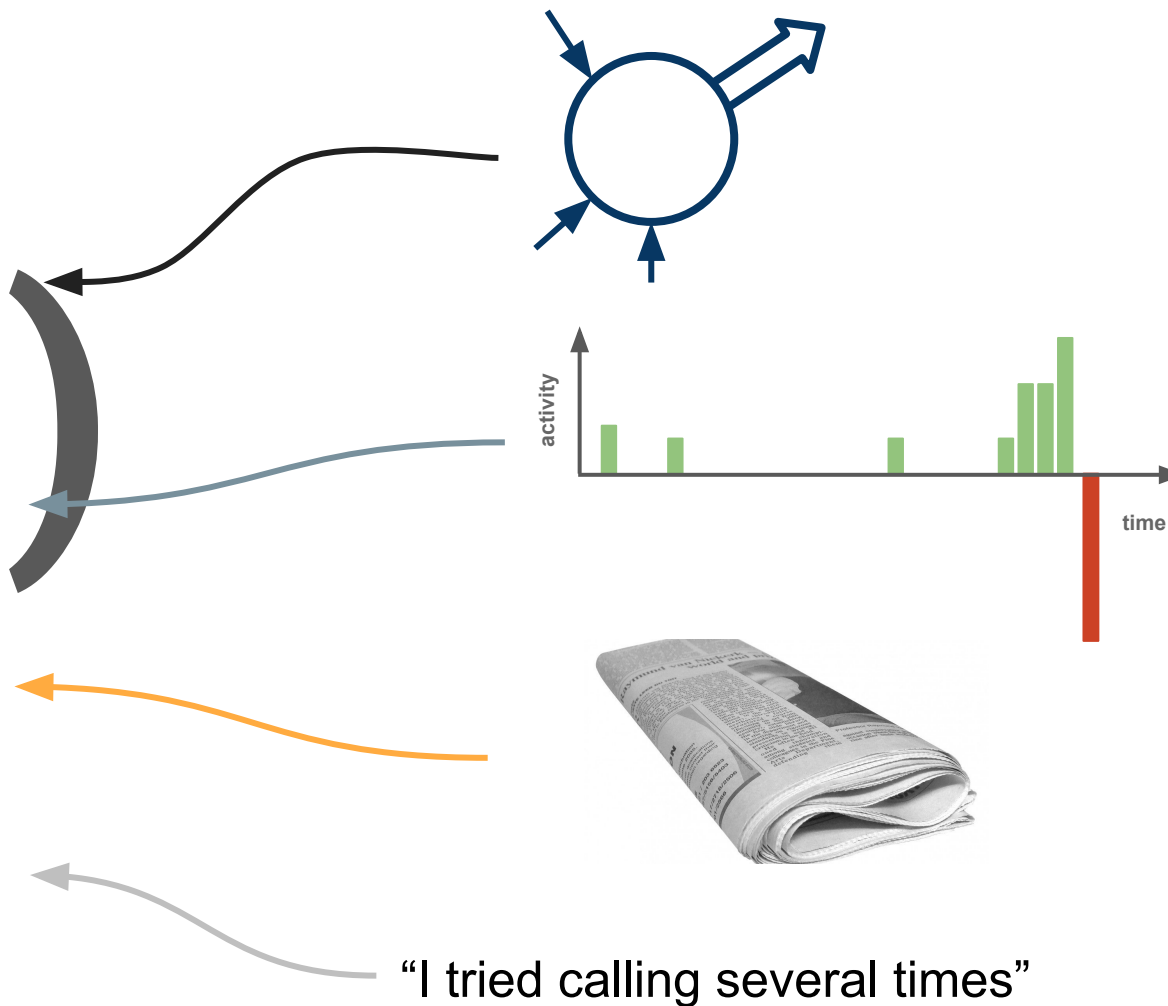
INDUSTRIALIZE the
implementation





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Individual	Feature 1
	Feature 2
	...
Images	
Network	Feature 1
	Feature 2
	...
Time series	Feature 1
	Feature 2
	...
External source	Feature 1
	Feature 2
	...
NLP (comm.)	Feature 1
	Feature 2
	...
In-house predictions	
Expert knowledge	





Use Cases

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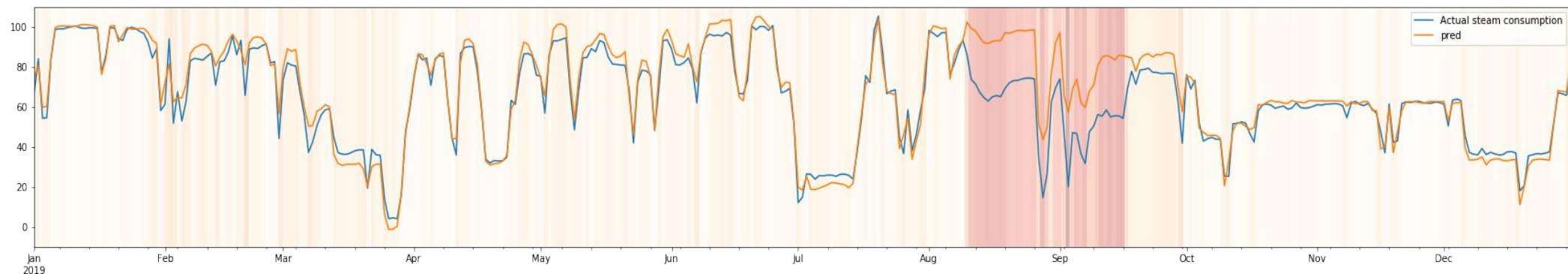
BASF | Predicting utility consumption

Description

- Utility dpt is responsible for **planning utilities** (electricity, gas, steam, etc)
- There are **~250 planning points** in total spread across multiple sub plants
- Available data sources:
 - **(Chemical) production** planning and actuals
 - **Historic** consumption / production
- Limited to **no time series characteristics**:
 - No autocorrelation, seasonality, ...
 - Biggest predictor: production planning

Challenges and solutions

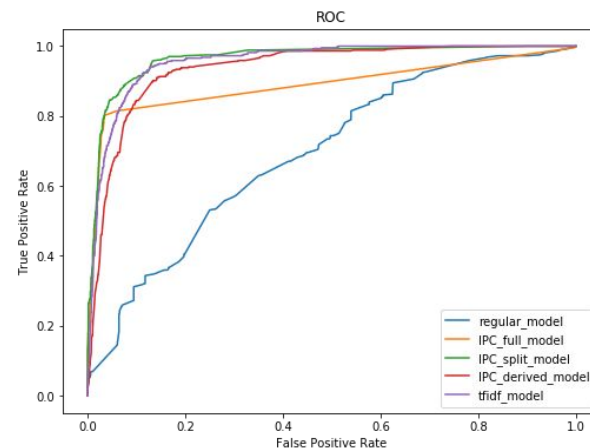
- Different characteristics across sub plants and planning points
 - Custom (lightweight) **AutoML**
- Deployment: complicated architecture with many on-premise servers and security layers
 - **Azure implementation:**
 - Azure Data Factory
 - Azure ML Pipeline
 - Azure Function
- Confidence in prediction
 - Many tailored **'uncertainty' flags**



Total | Patent classification

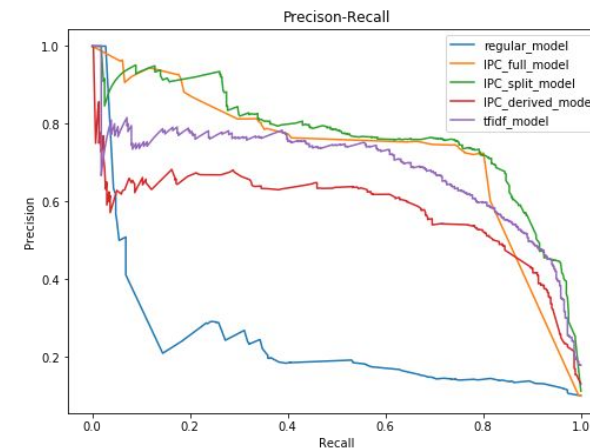
Description

- There are a massive number of new patents published every year, the goal is to **automatically extract the most relevant / interesting** ones (subjective interestingness)
- There is a large databases of historic patterns with **labels** (patents that were looked into are labeled “interesting”)
- Secondary goal is to **detect trending topics** (e.g. spot new technologies coming up)

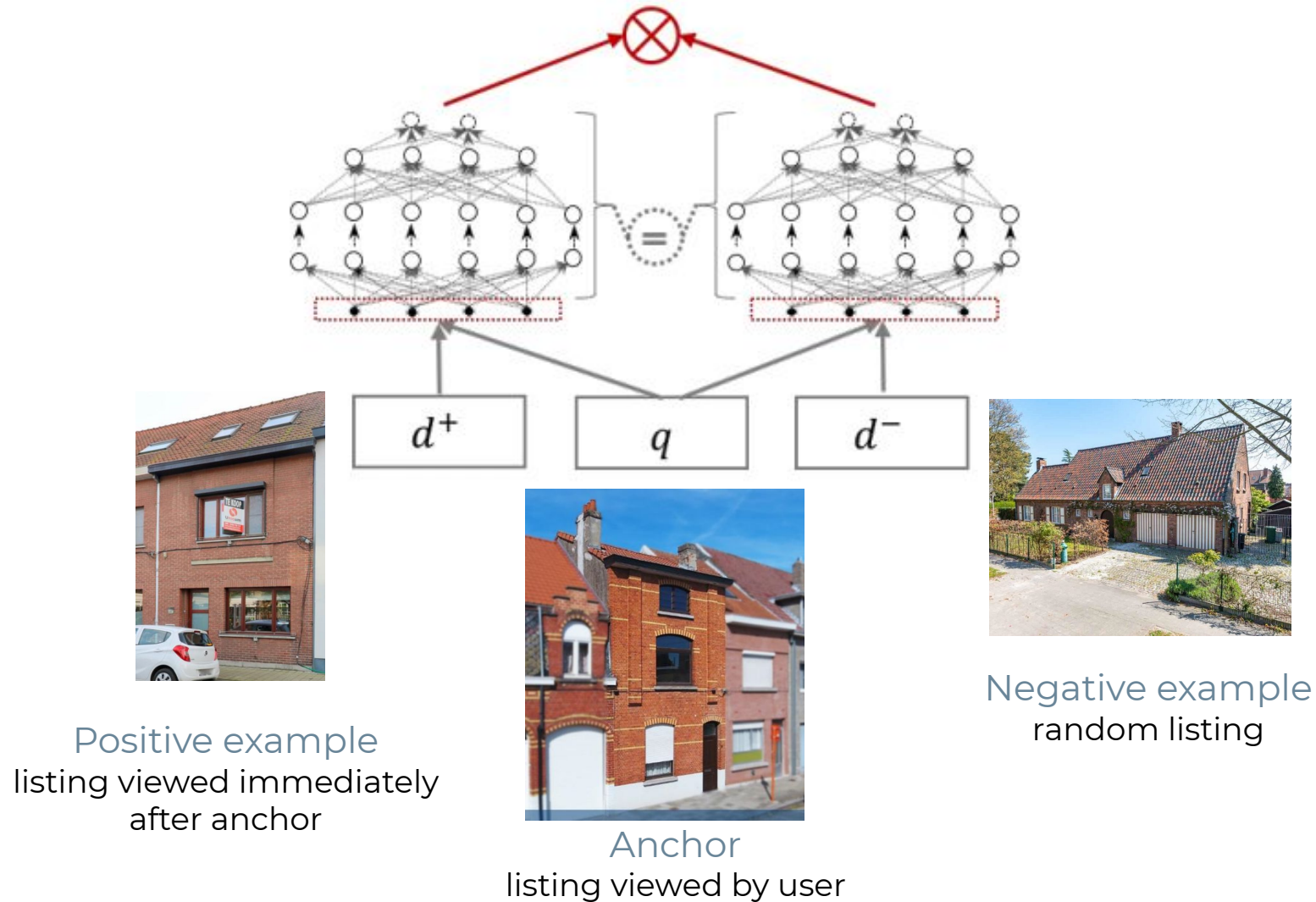


Challenges and solutions

- **Feature engineering**
 - Patent metadata (e.g. publication date, IPC classification, ...)
 - NLP: embeddings, tf-idf weighting, ...
- Avoid **overfitting**
 - Simplify features
 - Further NLP filtering of noisy words
- General model performance
 - **Ensembling** of models with different feature sets



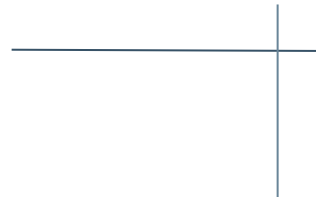
Co-libry | Similarity learning






AI in practice

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Expectation	Reality
A clear goal A year to investigate apply all techniques available Client involvement	A vague idea / a vision, but no strategy Budget restrictions Skepticism
Given <ul style="list-style-type: none">• target data• perfect, final version of the input data	Given <ul style="list-style-type: none">• a vague idea• some data sets, in various places
Data in the cloud As many CPUs, GPUs and RAM as you need	Often servers on premise (security, data ownership) Limited to available hardware

Data sets: expectation/research vs. reality



	Feature 1	Feature 2
1		
2		
3		
4		
5		
...		
1e9		



	Feature 1	Feature 2	...	Feature 1000
1				
2				
3				

Bizarre quotes

- “We are neural network experts. This data set is too small, so we cannot use NN. However, I will talk about NN for the next 20 mins.”
- “Statistics is dead. [...] Machine learning finds correlations in the data.”
- “We have automated the data science process. With the press of a button, we fit 10k+ models and return the best result. No need for data scientists anymore.”
- “Machine learning is only about fitting.”
- “... So, then the model needs to refit every night, so it can make predictions for new data points.”
- “The machine learning model will become smarter every time it sees a new data point”
- “One of our guys knows a little bit about machine learning, because he installed TensorFlow.”
- “Now that we have all our documents digitized, we can press *the Artificial Intelligence button* and make our business A.I. driven.”
- “All structured data has been converted into value with machine learning. Now, businesses should focus on unstructured data only.”



LUDWIG

de A.I. Assistant voor Accountants



Shift from compliance to proactive advice



Traditional accounting

1. **Link** data
2. **Exact** calculation
3. **Manual** checks and review
4. Standardisation **per** client
5. **Expert** based advisory
6. Automate **booking & expense**
7. **(Near) real-time** reporting



AI powered accounting

1. **Interpret** data
2. **Complex** calculation with **uncertainty**
3. **Automated** checks and review
4. Standardisation **over** clients
5. **Automated** advisory generation
6. Automate **closing & post-accounting**
7. **Predictive** reporting

Assists **mapping**
to an in-house
charter of
accounts



Ludwig Mapping

- Increased **consistency** across files
→ base for insights and review
- Automatic **reporting**
→ e.g. non-deductible expenses
- **Reduce time** consuming task
→ from hours to minutes

What Ludwig Mapping looks like for the user

Original account number & name

455000	TE BETALEN BEZOLDIGING
456300	PROV. VAKANTIEGELD BEDIENDEN
459000	PROV. EINDEJAARSPREM ARBEIDERS
488000	BORGTUCHTEN ONTV. IN CONTANTEN
490000	OVER TE DRAGEN KOSTEN
491000	VERKREGEN OPBRENGSTEN
550000	bnk
555000	ING 44-4444444-44
570000	KAS
578000	KAS V.ZEGELS
600000	BENODIGDHEDEN & GRONDSTOFF
604000	ONDERAANNEMERS
608000	ONTVANGEN KORTINGEN AANKOPEN
609000	VOORRAADWIJZIGINGEN HANDELSG
609400	VOORRAADWIJZIGINGEN BENODI
610000	HUUR GENT
610009	HUUR- BRUGGE
610010	HUUR

AI generated proposals for target account number/name

455000	Te betalen bezoldigingen
456000	Vakantiegeld
459010	Voorziening eindejaarspremie
488000	Borgtochten betaald in contanten
490000	Over te dragen kosten
491000	Verkregen opbrengsten
492000	Toe te rekenen kosten
!	550000 R/c bank

550000 R/c bank

Top voorspellingen

- 550000 R/c bank
- 530000 Termijndeposito's > 1 jaar
- 531000 Termijndeposito's > 1 m < 1 jaar







Andere

- 100000 Geplaatst kapitaal
- 101000 Niet-opgevraagd kapitaal (-)
- 110000 Beschikbare inbreng buiten kapitaal: uitgiftepremie



Ludwig | First a small intro to accounting



Ludwig Mapping		
 Ludwig Mapping		
 Submit  Submit and save  Cancel		
Ludwig Mapping Demo 3		
Not mapped (108)  Search in account in import		
Current mapping (0)		
Number in import	Name in import	Mapping proposal
0020	Plant & machinery cost b/f	110300 Plant and Machinery - Cost
0021	Plant & machinery dep'n b/f	110305 Plant and Machinery - Accumulated Depreciation
0022	Plant & machinery additions	 110301 Plant and Machinery - Cost - Additions
0023	Plant & machinery dep'n charge	110305 Plant and Machinery - Accumulated Depreciation
0030	Computer Equipment cost b/f	110750 Computer Equipment - Cost
0031	Computer dep'n b/f	110755 Computer Equipment - Accumulated Depreciation

Ludwig | First a small intro to accounting



Ludwig Nazicht		
Ludwig Nazicht A2	jan 2020 - dec 2020	14 mogelijke afwijkingen op 131 checks
	Voorbereiding	Afwijkingen
	Compact	
Context	Context	Resultaat Voor het boekjaar eindigend op 31-12-20 bedraagt het verschil tussen actief en passief €6.742,47.
Immateriële vaste activa	Mutatie	210009 - afschrijving kosten van onderzoek en ontwikkeling Mutatie t.o.v. vorig boekjaar verwacht met huidig saldo €-300,00.
Materiële vaste activa	AI Volledigheid	240009 - afschrijving meubilair Gelet op de aanwezigheid van gerelateerde rekeningen is deze rekening typisch ook ingevuld.
Vorderingen op ten hoogste 1 jaar	Tekencontrole	411000.000 - terug te vorderen btw Het saldo €-319,03 voldoet niet aan de tekencontrole.
Schulden op ten hoogste 1 jaar	Saldering	451000.000 - te betalen btw Recente saldering verwacht op deze rekening. Laatste saldering: 30-08-20.
Diensten en diverse goederen	AI Transactiewaarde	616202.000 - gsm De hoogste transactiewaarde bedraagt €699,00 en heeft een verwachte waarde tussen €0,00 en €59,00.

Ludwig | First a small intro to accounting



Mapper

Review

Overview

Ludwig Overzicht			
Recente zoekacties ▾		Zoek op dossiers of rekeningen	
	Dossier ↕	Tag ↕	Rekening ⇅
Type periode: toon enkel checks in ...			
<input type="checkbox"/> de laatste periode 285	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	100000.000 - geplaatst kapitaal Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input type="checkbox"/> de op één na laatste periode 343	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	110000.000 - uitgiftepremies Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input type="checkbox"/> het laatste volledige boekjaar 116	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	120000.000 - herwaarderingsmeerw op immater v. act Het saldo €1.000,00 voldoet niet aan de tekencontrole.
Aantal periodes per fiscaal jaar	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	121000.000 - herwmeerw mat v act./ nt afgeschr ged Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input checked="" type="checkbox"/> 1 393	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	121000.001 - herwmeerw mat v act/ afgeschr ged Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input checked="" type="checkbox"/> 12 253	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	122000.000 - herwaarderingsmeerw. op fin. vaste act. Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input type="checkbox"/> 4 28	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	123000.000 - herwaarderingsmeerw. op voorraden Het saldo €1.000,00 voldoet niet aan de tekencontrole.
Vennootschapsvorm	WinbooksACYW jan 2021 - dec 2021	Tekencontrole	124000.000 - terugnemng v. waarderingm. op geldbel. Het saldo €1.000,00 voldoet niet aan de tekencontrole.
<input checked="" type="checkbox"/> bv/srl 315			
<input checked="" type="checkbox"/> other/unknown 226			
<input checked="" type="checkbox"/> nv/sa 105			

In short, Ludwig helps the accountant to ...

LUDWIG Mapping

... easily and quickly get consistent files and automatic reporting across all companies

LUDWIG Review

... automatically detect mistakes and opportunities for advice in the financial data

LUDWIG Forecast

... track budgets and cash flow, optimise prepayments, etc by providing reliable forecasts

LUDWIG Benchmark

... easily position their clients within a group of peers in order to extract insights

Coming soon...



Thank you

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