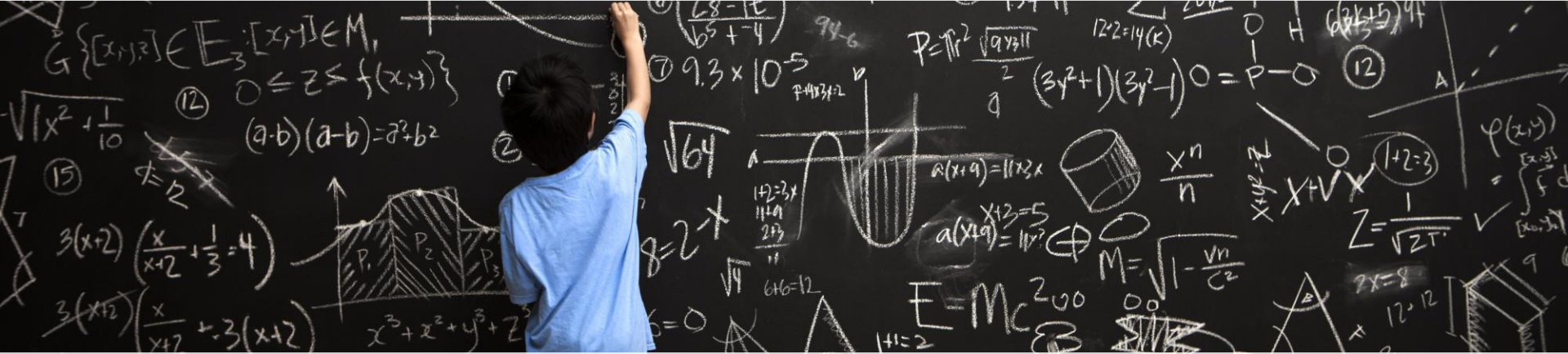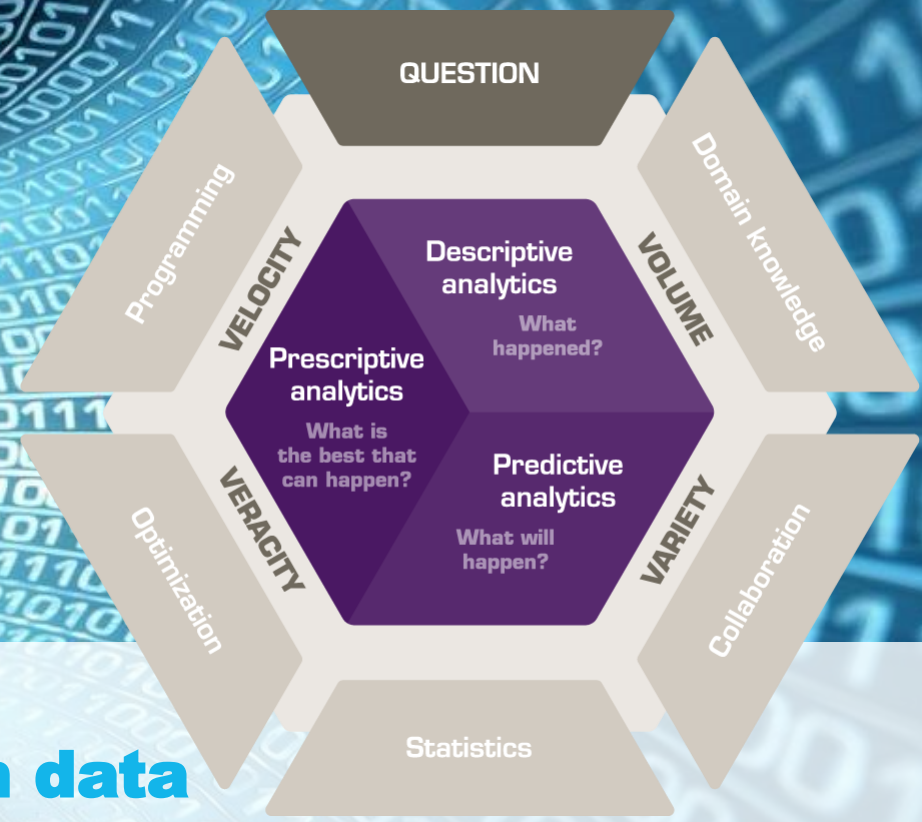# We believe in the power of mathematics...

Arjen Vestjens

Managing Partner

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cqm

Consultants in Quantitative Methods

... and innovation based on data

Is Data Science a game changer for Operations Research?

3

cgm
Consultants in Quantitative Methods

Who cares???
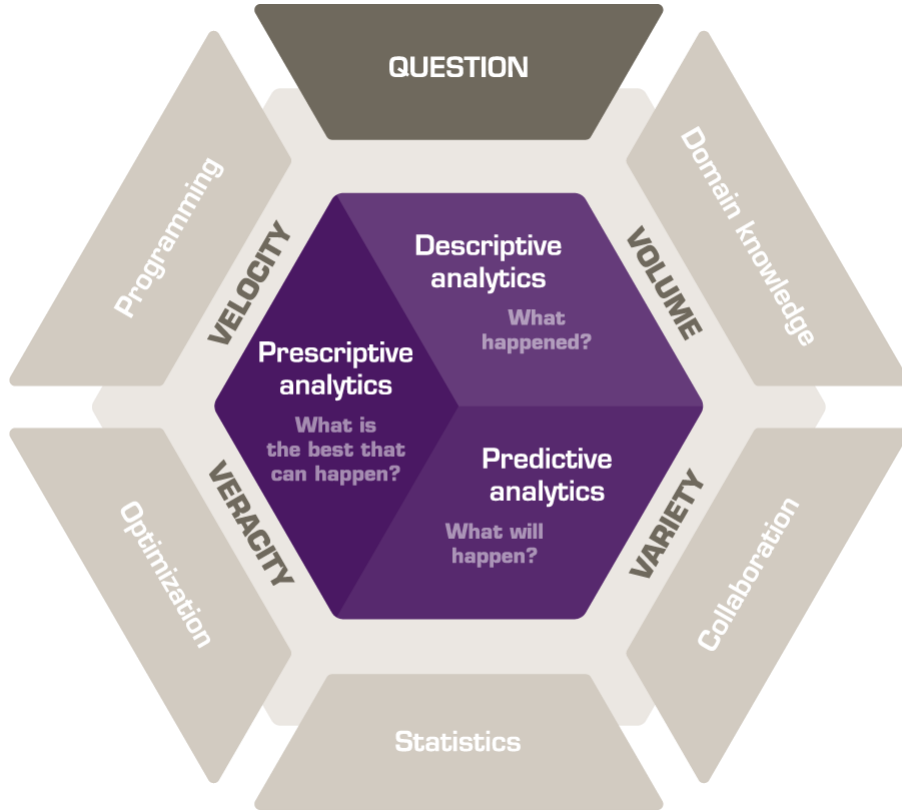## Everybody is talking about Artificial Intelligence

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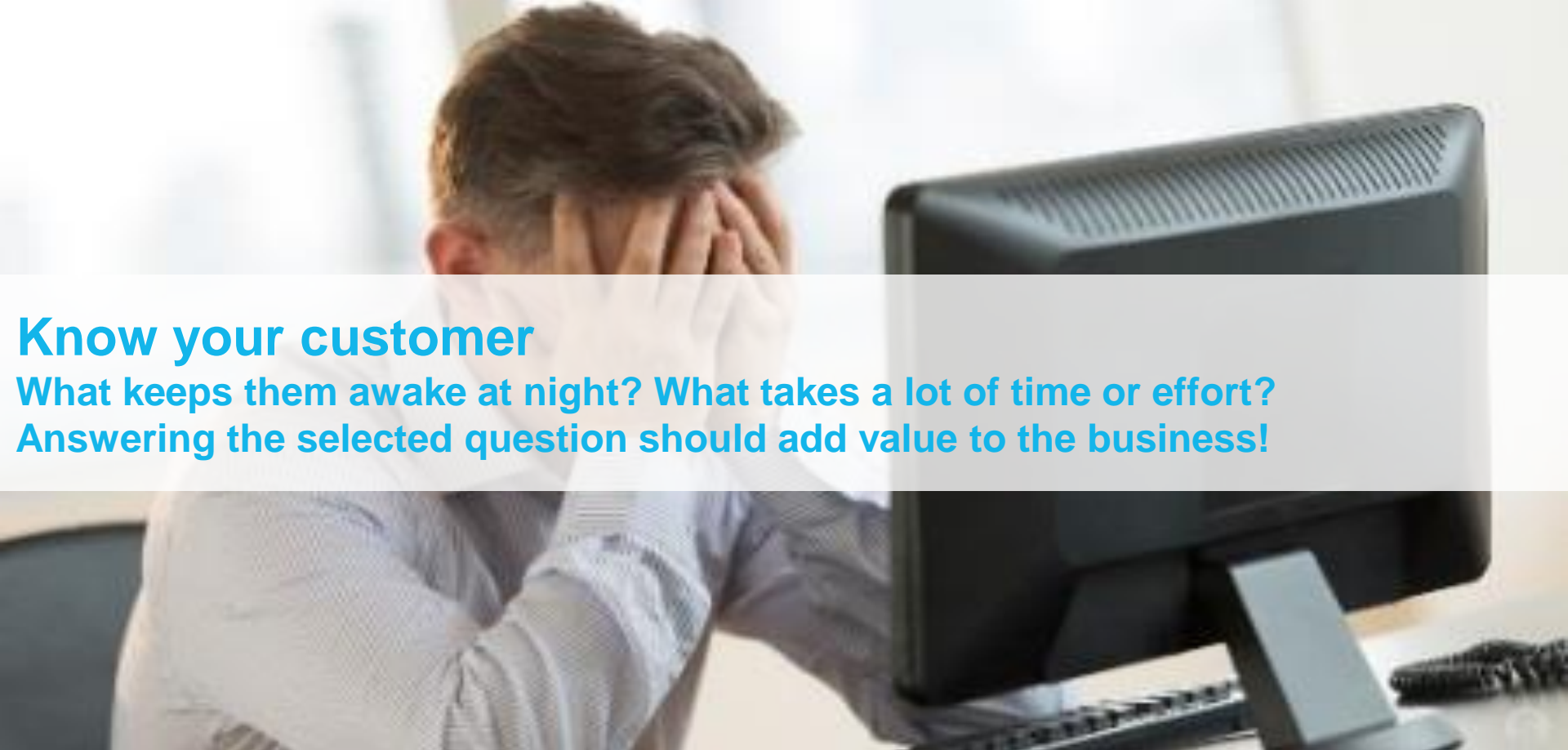
Show me the money!!!
It's all about added value

"… it seems that the Dutch Operations Research community (both in academia and industry) is **not eager** to embrace Data Science as a valuable addition to Operations Research. Industry, however, seems to look more and more for Data Scientists who are broader educated than Operations Researchers. This observation triggers several questions. Should current Operations Research practitioners get better acquainted with the developments in Data Science and **expand** their **skill set**? Should Data Science courses be included in educational programs, such as our MSc and PhD programs? What are the scientific and **practical challenges** when Operations Research is combined with Data Science? Is it time to step out of our **comfort zone**?"

From energy supplier to energy partner

From data to smart solutions

Complex business made easy for growers

Know your customer

What keeps them awake at night? What takes a lot of time or effort? Answering the selected question should add value to the business!

Agro Energy

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BidOptimal

Award winning Data Science

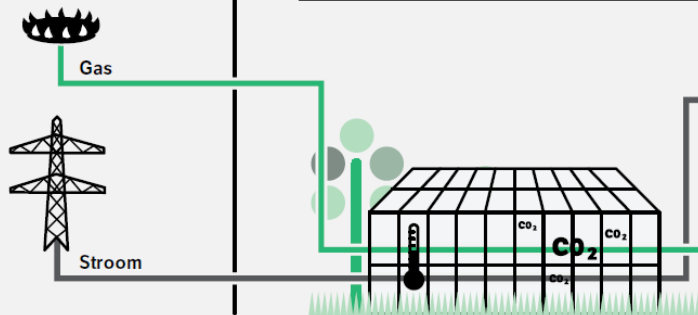and Optimization

in the Agro & Food sector

Growers become energy suppliers

Forecasts for future heat and power consumption and gas and electricity prices, and optimization to make the ultimate bid at the energy market

1 Warmte- en CO2-behoefte van de tuinder over de komende vier dagen

2 De gas- en energieprijzen op de APX (elektriciteitsmarkt) en TTF (gasmarkt)
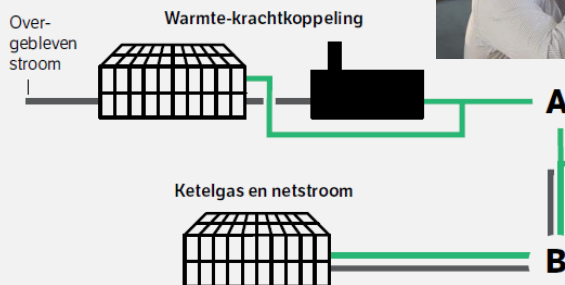
Gas

Stroom

BIEDOPTIMAAL

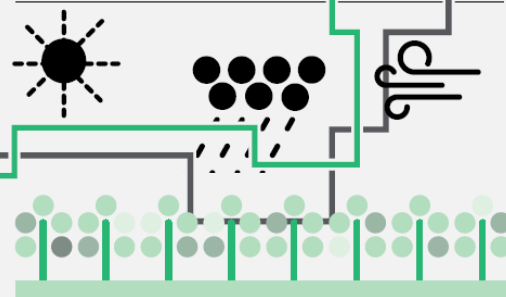BiedOptimaal weegt verschillende factoren en kiest de meest lucratieve optie.

A: de warmte-krachtkoppeling aanzetten. Die heeft meer gas nodig, maar levert warmte, CO_2 én stroom.

Of **B**: de ketel aanzetten. Die heeft minder gas nodig, en levert ook warmte en CO_2, maar geen stroom. Die moet extra worden ingekocht.

4 Alle factoren worden gewogen en BiedOptimaal maakt een keuze tussen ketelgas en het stroomnet of de warmte-krachtkoppeling

Over-gebleven stroom

Warmte-krachtkoppeling

A

Ketelgas en netstroom

B

3 Verwachte weersomstandigheden

ILLUSTRATIE BOUDEWIJN VAN DIEPEN

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Data Science and OR in BidOptimal

Predictions

Predictive Analytics

MeteoConsult

- …
- …
- …
- …
- …

REGRESSION

Data Science and OR in BidOptimal

☞ **Optimization**

- …

- …

- …

- …

➢ …

MILP

Prescriptive
Analytics

Mathematics under the bonnet

=

Data Science and OR in practice

- Create model that is trusted by growers

- Use many data sources for creating a bid

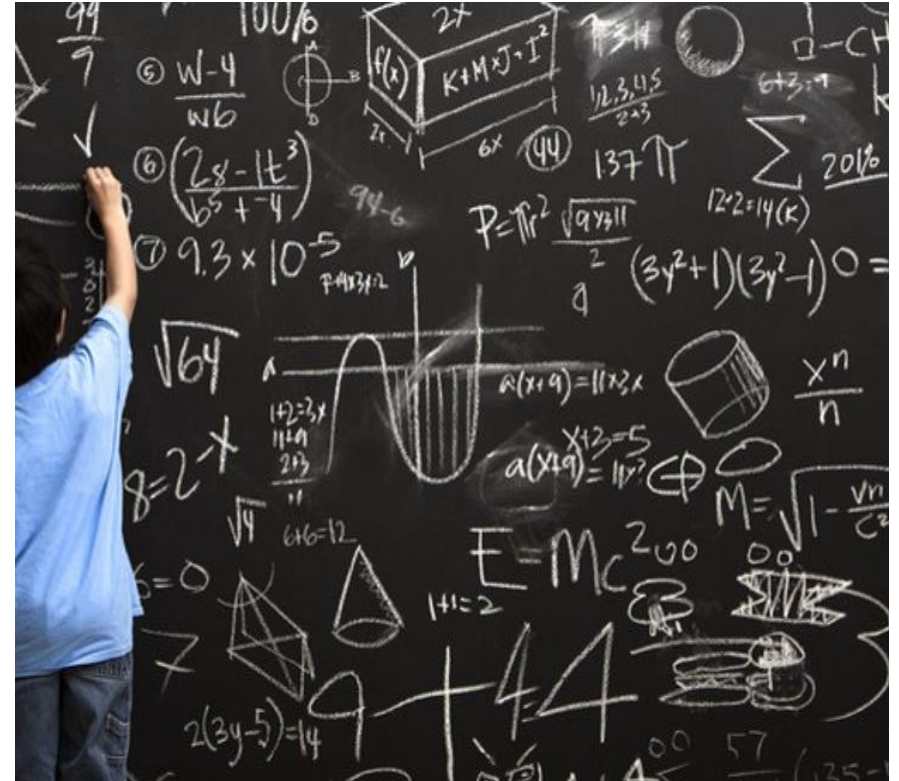- Short timeframe

- Always an answer

Mathematics under the bonnet

=

Data Science and OR in practice

- Create model that is trusted by growers
  [NO BLACK-BOX; USE DOMAIN KNOWLEDGE]

- Use many data sources for creating a bid
  [PARTIALLY IMPERFECT OR MISSING DATA]

- Short timeframe
  [USE TAILORED METHODS & PARALLELLISM]

- Always an answer
  [USE ROBUST MECHANISM]

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**Challenges from practice to
Data Science and OR research**

☞ Design models and methods that enable **integration** of expert domain knowledge to get immediately usable results fastest

☞ Models and methods need to be **transparent** or require methodology that explain the outcomes to gain trust by users

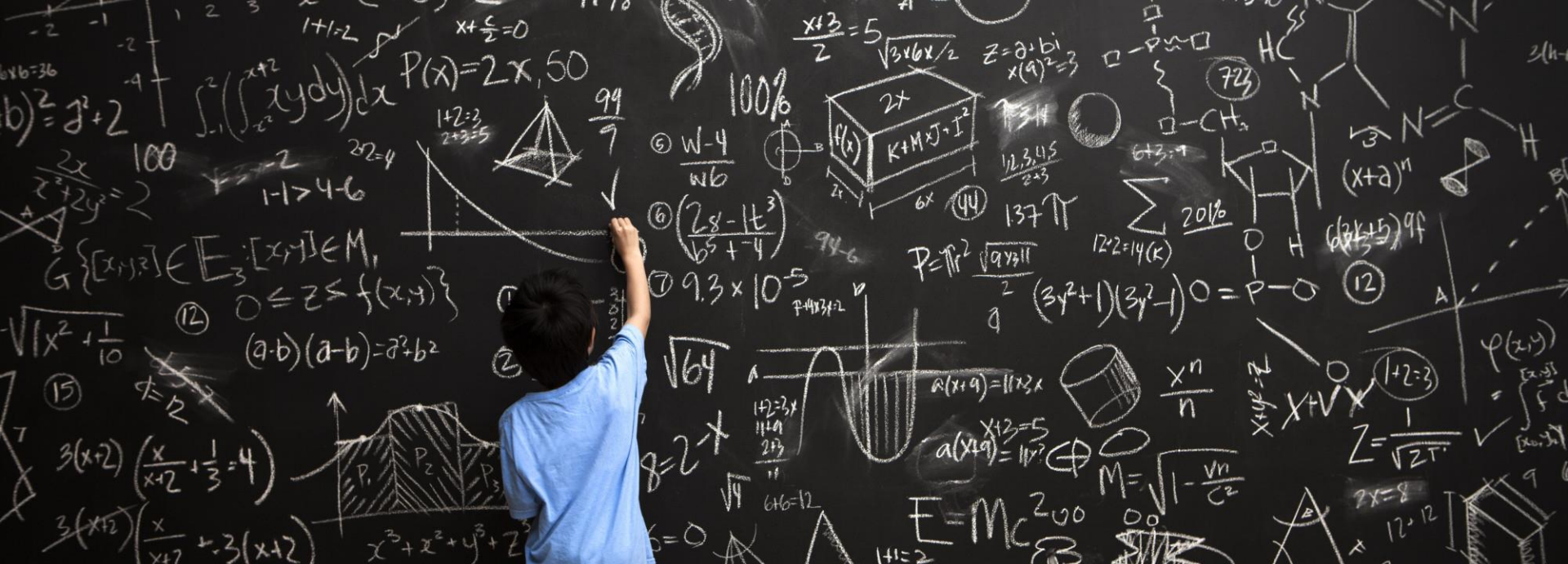☞ Models and methods need to be **robust** against contaminated or missing data

Consultants in Quantitative Methods

"You know you will get the most return from your energy installations"

"BidOptimal gives peace of mind"

"You save more than just money, you also save time"

Customer experience

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Announcement: Data Science on TV – Deep Learning Application

- Sun 28-01-2018 17:00

- Deep Learning in Railway Inspection

- Joint work Asset.Insight.

VolkerWessels