AI Technologies for the insurance sector
Trends, problems and solutions

Caspar Chorus
Hoogleraar *Wiskundige modellen van keuzegedrag*
Afdelingshoofd *Engineering systems*
Ondernemer *Councyl*

TU Delft
Quiz time!

How do people answer to the question:

**Should judges be replaced by AI?**

- **NO!** We need human empathy, emotions, understanding
- **YES!** We should get rid of human bias, subjectivity
- It depends / I don’t know / no response
Quiz time!

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Roughly equally distributed...

*(Helberger et al.)*
Quiz time! (2)

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- It would work for others, but not for me, because I am unique
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*(Longoni et al.)*
Quiz time! (3)

And the most important of all:

**Is AI any good at recommending jokes?**

- **YES**, people like jokes recommended by AI better than those recommended by humans
- **NO**, people like jokes recommended by humans better than those recommended by AI
- **It depends:**
  - When people know the joke is recommended by AI, they don’t like it.
  - When they do not know this, they like AI-recommended jokes better
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*(Agrawal et al.)*
What does this Quiz tell us?

**We are a bit confused about AI**

This should come as no surprise...

AI is a so-called *key technology* (sleutel-technologie) and we simply cannot oversee its consequences.

But let’s try anyway, and see what AI can and cannot do for the insurance sector.
Evolution of AI – Insurance

Like in many other fields, AI (machine learning) often and increasingly used for **analysis and making predictions**:

- Chance that this claim is fraudulent
- Chance of a pandemic or once-in-a-lifetime storm next year
- Chance that this person will have a car-accident next year...
- ...if yes, what is the 95% confidence interval of expected damage
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And, since more recently, increasingly being used for automating decision support and decision making:

- Automated flagging and prosecution of fraudulent claims
- Automated pricing suggestions for insurance applications
- Automated accepting / rejecting applications, claims
The result? Justified concerns…

**DNB/AfM 2019:** *Ethiek, Consumentenvertrouwen, Reputatierisico* seen as most important AI-challenges according to insurers.

**Why is that?**

Very hard to understand *why* the AI made its predictions, decisions. So, we don’t know if its reasons, motivations align with our values.
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Why is that?

The AI is based on machine learning-techniques: ‘black box’

The data on which the AI is trained, may contain ‘implicit bias’

Fear of loosing “Meaningful Human Control”
Problem: Black Box

Machine learning, e.g. Artificial Neural Networks (ANNs), uses an extremely flexible but in-transparent web of connections.
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This is not an accidental feature! Lies at the heart of ANN’s success.
Problem: Implicit Bias

Machine learning needs massive amounts of data for training. Data often involves past choices made by humans. If those contain traces of ‘bias’: they will end up in the machine. And worse: they are very hard to spot early, given the black box...

Funny: Q: what makes this a husky, and not some other dog?
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**Funny:** 
Q: what makes this a husky, and not some other dog?

**Not so funny:**
Q: what makes that this CV is not invited for interview?  
Q: what makes that this inmate will not be given parole?  
Q: what makes that this person pays more for her insurance?  
A: ‘algorithmic discrimination’ *(misnomer!)*
(some) Hope: ‘greying the black box’

There has been good progress in increasing the interpretability of artificial neural networks

• **‘Heat-mapping’**: What data-point made the ANN generate a particular prediction?

• **Prototyping**: Ask ANN to draw a prototypical example of a prediction.

But there is a **fundamental limit** to this! Will never reach full interpretability...
The wave of the future: decouple analysis from decisions

**Machine Learning** confined to **analysis**, making predictions:

- When perfect interpretability is not demanded
- Use interpretability-enhancing tools where needed

**Other methods** are used to automate **decision**-making

- Interpretability, accountability are key requirements
- But **HOW**?

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AI-powered (machine learn.)

prediction module

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Human-inspired (domain experts)

decision-making module
How to automate human decision making and domain expertise?

**Rule-based systems? IF–THEN**
- Perfectly interpretable, **but:**
  - **Rigid**
  - **Too generic**
  - **Very hard to elicit**

**Discrete choice analysis**

**DATA:** Choice Experiments
- Carefully crafted and statistically efficient choice tasks

**MODEL:** Choice Models
- Use observed choices to estimate weights, trade-offs
Example: setting price (\textit{Premie}) for a car insurance application

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chance of \textit{Accident}</td>
<td>3.5%</td>
<td>1%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Confidence interval \textit{Damages}</td>
<td>10K – 35K</td>
<td>20K – 25K</td>
<td>50K – 60K</td>
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<tr>
<td>Chance of \textit{Fraud}</td>
<td>5%</td>
<td>7.5%</td>
<td>10%</td>
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<tr>
<td>\textit{Premium}</td>
<td>250</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>YOUR CHOICE (acc. / rej.)</td>
<td>□</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>YOUR CHOICE (best deal)</td>
<td>□</td>
<td>●</td>
<td>□</td>
</tr>
</tbody>
</table>

\textbf{Result:} mathematical model of the weights, trade-offs of experts

\[ U = -.0167 \cdot Acc - .0232 \cdot Damage - .178 \cdot Fraud + .0652 \cdot Premium \]

e.g. a 1\% increase in \textit{Acc} is compensated by a 13.4 euro increase in \textit{Premium}. Or, a 1\% increase in \textit{Fraud} is compensated by... etc.
Best of both worlds

- Harnessing the power of AI
- While maintaining Meaningful human control

\[ U = -0.0167 \cdot Acc + 0.0232 \cdot Dam + 0.178 \cdot Fraud + 0.0652 \cdot \text{Premium} \]
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Current status:

Development of **moral** choice models

Pilot studies for MinDef, UMCG

Discussion started with DNB, AfM

Ready for exploring value proposition for your company

\[ U = -0.167 \cdot Acc + 0.0232 \cdot Dam - 0.178 \cdot Fraud + 0.0652 \cdot Premium \]
Thank you for your attention!

Questions?

Discuss with me or with Nicolaas Heyning, Hubert Linssen, during the break or over lunch!