BIG DATA MEETS ARTIFICIAL INTELLIGENCE
CHALLENGES AND IMPLICATIONS FOR THE SUPERVISION AND REGULATION OF FINANCIAL SERVICES

Dr. Stefan Rüping | Fraunhofer IAIS |
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Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS
Digital Innovation powered by Machine Learning

Question answering and dialogue systems
Personal assistant systems

Cognitive Process Automization
Automated decision making from documents

Fraud Detection
Real-time detection of credit card fraud

AI & ML Studies
Studies with PwC, BMBF, Fraunhofer, BaFin
Today’s definition of Artificial Intelligence

AI as a Triumvirate

- Machine Learning
- Big Data
- Computing Power

Enabler of AI:
- Computing power
  - Growing computational power and cheaper technologies
- Big Data
  - Like social media and sensor data
- Machine Learning
  - For example Machine Learning methods like Deep Neural Networks
Machine learning (ML) comprises three different types of learning methods:

<table>
<thead>
<tr>
<th>Supervised Learning</th>
<th>Unsupervised Learning</th>
<th>Reinforcement Learning</th>
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<tbody>
<tr>
<td>Prognosing a target variable from explanatory variables</td>
<td>Extracting intrinsic patterns from unlabeled data sets</td>
<td>Independent learning of strategies to maximize reward</td>
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<td>Example applications:</td>
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<tr>
<td>- Image recognition</td>
<td>- Natural language processing</td>
<td>- Behavior training of robots</td>
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<td>- Prediction of stock trading</td>
<td>- Anomaly detection for predictive maintenance</td>
<td>- Training game agents to learn the rules of Go &amp; Chess</td>
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ML is ideally suited to replace repetitive tasks provided large amounts of data are available.
Case Study: Credit Card Transactions
Using Artificial Intelligence to detect fraud in real time

Situation
- Credit card fraud causes $23 bn in damage worldwide per year*
- Investigation of fraudulent behavior is often done by hand on a subjective basis

Fraunhofer contribution
- Developed Artificial Intelligence algorithm to detect fraud in real time
- Successfully launched software together with a leading European payment processor

Results
- Protection of millions of credit card holders and significant reduction of fraud cases
- Automatic, objective and highly efficient countermeasure

Source: *The Nilson report, October 2017, Issue 1118

*Credit card fraud causes $23 bn in damage worldwide per year*
Case Study: Contract Analytics
Using Artificial Intelligence to process contracts

Situation

- **New reporting standards** force insurance companies to review thousands of contracts
- Current procedures require a lot of manual work to extract structured information from current contracts

Fraunhofer contribution

- Developed **self-learning text mining** algorithm that „understands“ contracts and extracts desired information automatically
- Used **highly flexible modular architecture** to deal with complexity of document types

Results

- High performance text mining solution which keeps continuously evolving through user feedback
- Solution is applicable for huge variety of contracts leading to significant reduction of required manual work
Big Data meets Artificial Intelligence
Challenges and implications for the supervision and regulation of financial services

“The following report describes the interaction between Big Data and Artificial Intelligence; how fundamentally the BDAI phenomenon can change the financial system; and what implications this has for supervisory and regulatory bodies.”

Felix Hufeld
President of BaFin

Source: Big Data meets Artificial Intelligence, Challenges and implications for the supervision and regulation of financial services, BaFin, 2018
Big Data meets Artificial Intelligence

Regulatory implications for technology used

Prerequisites to use BDAI
- Responsibility of supervised firms to ensure that BDAI-based decisions are comprehensible and are understood by third-party experts
- Need to develop common standards for supervisory approval for use of BDAI-based models

Non-discrimination
- Responsibility of supervised firms to prevent unlawful discrimination of individual customers or customer groups
- Both, programming algorithms and controlling the generated results need to be addressed in this context

Data protection & sovereignty
- Creating awareness among customers how their data are used and processed and which data are critical in order to receive the desired service
- Closer cooperation between supervisory authorities and data protection authorities is expected

Source: Big Data meets Artificial Intelligence, Challenges and implications for the supervision and regulation of financial services, BaFin, 2018
Societal acceptance of AI is challenged
Four fields of action need to be addressed in order to build trust

I. Comprehensibility of Models
II. Data privacy
III. Non-discrimination
IV. Data Sovereignty
Comprehensibility of algorithmic decisions is crucial for societal acceptance
LIME algorithm as an example for new research approach

<table>
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<tr>
<th>Algorithm</th>
<th>The LIME (Local Interpretable Model-Agnostic Explanations) algorithm explains predictions of complex models by local effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 1: LIME</td>
<td>![Image of Labrador playing guitar] <strong>Option 1:</strong> Electric guitar</td>
</tr>
<tr>
<td>Example 2: „Black</td>
<td>![Image of Husky] <strong>Husky</strong>&lt;br&gt;Algorithm <strong>does not provide comprehensible</strong> „reasoning“ why Husky has been classified as wolf</td>
</tr>
<tr>
<td>Source: „Why Should I Trust You?“ Explaining the Predictions of Any Classifier; M.T. Ribeiro, S. Singh, C. Guestrin</td>
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</table>
Non-discrimination as a key prerequisite for AI applications

Microsoft’s Tay chatbot

Example

- Microsoft released Artificial Intelligence Twitter-chatbot Tay that was trained by tweets from the public community.
- Soon after the release, Tay started to post offensive and discriminating tweets that forced Microsoft to terminate the service.

Challenge

- How can discriminating behavior be prevented? (Removing certain features such as gender etc. is not sufficient.)
- How can legal & ethical standards be translated into mathematical rules?

Many approaches to prevent discriminating behavior but no final solution.
Key Take Aways & Further Information

- BDAI is disrupting the insurance market, resulting in **new, digital-born market players and non-traditional products** (e.g. selling anonymized data)

- Embracing the opportunities offered by BDAI, insurance companies can become **highly customer-centric** and address **radical cost savings** at the same time

- Rise of data-driven technologies and business models offers **opportunities and risks for society** that need to **addressed by regulatory authorities**

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**Dr. Stefan Rüping**
Deputy Head of Department KD  
Fraunhofer IAIS  
Stefan.Rüping@iais.fraunhofer.de
www.iais.fraunhofer.de  
www.bigdata.fraunhofer.de/de/datascientist.html