

# Artificial Intelligence: Opportunities and Pitfalls

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## 1 I Current state and future of AI What is Artificial Intelligence?





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Source: Perin, Rodrigo, Thomas K. Berger, and Henry Markram. "A synaptic organizing principle for cortical neuronal groups." Proceedings of the National Academy of Sciences (2011): 201016051.

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## 11 Current state and future of AI What is Artificial Intelligence?



Source: Riedel, Sebastian, Matko Bosnjak, and Tim Rocktäschel. "Programming with a differentiable forth interpreter." CoRR, abs/1605.06640 (2016).

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# Artificial Intelligence today



Source: Battaglia, Peter W., et al. "Relational inductive biases, deep learning, and graph networks." arXiv preprint arXiv:1806.01261 (2018).

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## 1 I Current state and future of AI Natural Language Processing and Understanding



Arrangement of words in a sentence. The grammar of a language defines the accepted syntax.

Semantics

sentence.

The meaning of the

#### Semantic structures

Speakers use a limited number of sentence structures used recursively.

Statistical approach

Related terms co-occur in text

bodies

#### Example use cases



Detection of improper language, aggression and bullying (internal compliance)

What is the tone of the communication? Automatic quality management of call centers

Extraction of data from text

Document classification: expense classification based on OCR'd invoices

Intent identification: email inquiries automatically forwarded to the right operator



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NLP&U

ML

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## 1 I Current state and future of AI The challenges in NLP/NLU



## Dealing with ambiguity

#### Anaphoric:

- I can't put the luggage on the table, it is too heavy
- I can't put the luggage on the table, it is too high

#### Semantic:

— John kissed his wife, so did Sam

#### Syntactic:

- Time flies like an arrow. Fruit flies like a banana
- Domain specificity:
- Bats vs baseball bats

#### Semantic representations

Languages are rapidly evolving:

- new words, new slang
- new symbols (ex: emoji's)

Semantic representations allow us to generalize reasoning, abstracting from specific of lexical and syntactical choices.



Source: Wang, Xiaojuan, et al. "Language differences in the brain network for reading in naturalistic story reading and lexical decision." PLoS One 10.5 (2015): e0124388.



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#### 1 I Current state and future of AI – Natural Language Processing and Understanding Prescriptive Analytics





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# Entity Resolution



### 2.1 I Selected AI Usecases in FS What is Entity Resolution?

Also known as: duplicate detection, (probabilistic) record linkage, deduplication, co-reference resolution, hardening soft databases, reference matching, object identification, object consolidation, merge/purge





the task of finding records that refer to the same entity across

different data sources





# 2.1 I Selected Al Usecases in FS – Entity Resolution





#### 2.1 I Selected Al Usecases in FS – Entity Resolution Case Study: DBLP-Scholar

#### Problem: DBLP-Scholar

<u>Real world dataset</u> used in academia and in the industry for comparative performance evaluation of Entity Resolution algorithms. DBLP-Scholar is the merge of two databases of scientific journal publications. As a result of the merge, there are some duplicates in the dataset. The goal: identify them.

### Solution: We beat Jaro-Winkler<sup>1</sup>



1) William E. Winkler. (1999). "The State of Record Linkage and Current Research Problems.", Statistics of Income Division, IRS Publication R99/04

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# Customer Analytics



## 2.2 I Selected Al Usecases in FS What is Customer Analytics?



Personalized promotional campaign

User-aware mobile and web products

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## 2.2 I Selected Al Usecases in FS – Customer Analytics





#### Marcus Faber

#### Age: 33

#### Job: Computer Scientist

High cash account balance to monthly income: Marcus might be interested in **savings and investment plans.** 

Event:

- Purchase at a Starbucks coffee
- Stock Recommendation:
- SBUX
- Real-time financial news



#### Janice Müller

Age: 38

#### Job: Manager in a Pharmaceutical Company

Janice spends over 20% of his monthly income on rent. Janice might be interested in buying a flat and therefore she should be presented **mortgage opportunities**.

**Geolocation** data allows the bank understand where the user spends his time and provide **tailored information on real estate**.



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## 2.2 I Selected Al Usecases in FS – Customer Analytics Recommender Systems: Intuition





— Dealing with sparsity

Co-Clustering alternatives

![](_page_18_Figure_5.jpeg)

![](_page_18_Figure_6.jpeg)

- Ranking of preferences
- Online learning

![](_page_18_Figure_9.jpeg)

![](_page_18_Picture_10.jpeg)

![](_page_19_Picture_0.jpeg)

## 3 I AI Pitfalls and how to avoid them

![](_page_20_Figure_1.jpeg)

![](_page_20_Picture_2.jpeg)

### **3 I AI Pitfalls and how to avoid them** Pitfalls and Effects

![](_page_21_Figure_1.jpeg)

![](_page_21_Picture_2.jpeg)

### **3 I AI Pitfalls and how to avoid them** Pitfalls on your way

![](_page_22_Figure_1.jpeg)

![](_page_22_Picture_2.jpeg)

### 3 I Al Pitfalls and how to avoid them Pitfalls on your way

![](_page_23_Figure_1.jpeg)

![](_page_23_Picture_2.jpeg)

## 3 I Al Pitfalls and how to avoid them Measure #1: Strong Methodogical Approach

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- Specify problem (Root Cause, 5 Whys, ReqEng) incl. benchmark
- Review data availability & data quality
- Define best solution approach (organisational vs. analytical)

![](_page_24_Figure_5.jpeg)

![](_page_24_Picture_6.jpeg)

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## 3 I Al Pitfalls and how to avoid them Measure #2: Agile Analytics

![](_page_25_Picture_1.jpeg)

- For Planning: Focus on low hanging fruits early success, build trust within team & stakeholders, room for learning
- For Execution: Have an experimental mindset (until deployment) prototype first and gradually build database and models

![](_page_25_Figure_4.jpeg)

![](_page_25_Picture_5.jpeg)

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#### 3 I AI Pitfalls and how to avoid them

## Measure #3: Leverage existing Skills & Technology

![](_page_26_Picture_2.jpeg)

- Reuse Technology which works (DWH, DB etc.) and for which knowledge is present
- Incorporate DWH/DB experts in AI teams
- Support Scientists with Engineers

![](_page_26_Figure_6.jpeg)

![](_page_26_Picture_7.jpeg)

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### 3 I Al Pitfalls and how to avoid them What are Your Pitfalls and Measures?

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![](_page_27_Picture_2.jpeg)

![](_page_28_Picture_0.jpeg)

# Thank you

![](_page_28_Picture_2.jpeg)

![](_page_28_Picture_3.jpeg)

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![](_page_29_Picture_5.jpeg)

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