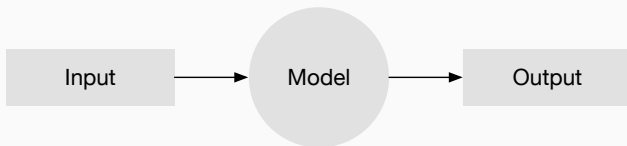# – Seminar –
Cognitive Reasoning

Methods, Algorithms, and Statistics to Discern Human from Artificially Generated Data

apl. Prof. Dr. Dr. Marco Ragni
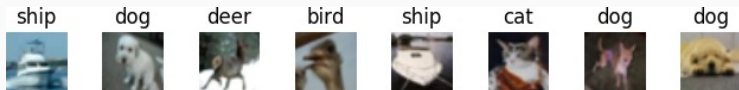Nicolas Riesterer, Daniel Brand

October 21st, 2019

Cognitive Computation Lab,
Department of Computer Science,
University of Freiburg

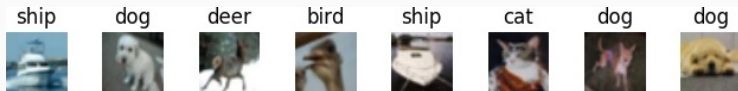Often, it is possible to directly interpret a model's output.

Training Dataset:

Training Dataset:

| ship | dog | deer | bird | ship | cat | dog | dog |

Model Output:
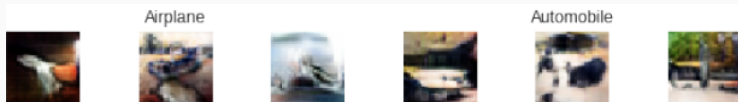
Assessment of ground truth is possible.

Example 2: Human Syllogistic Reasoning

- Categorical quantified assertions (All, Some, Some ... not, No)
- Two premises, three terms (A, B, C)
- Goal is to infer relationship between A and C using one of the four quantifiers or "No Valid Conclusion" (NVC)
- Human conclusions differ substantially from classical first-order logic

All B are A
No C are B

What, if anything, follows?

Example 2: Human Syllogistic Reasoning

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- Goal is to infer relationship between A and C using one of the four quantifiers or "No Valid Conclusion" (NVC)
- Human conclusions differ substantially from classical first-order logic

All B are A
No C are B

No A are C (data)
Some A are not C (logic)

Example 2: Human Syllogistic Reasoning

Training Dataset:

Subject-ID	AA1	AA2	AA3	AA4	AI1
1	Aac	Aca	NVC	Ica	Iac
2	Aac	Aac	Aac	Aac	Aac
3	Ica	Iac	NVC	Iac	Ica
4	Aac	Aca	Aac	Ica	Iac
5	Aac	Aca	NVC	Aca	NVC
6	Aac	Aca	Aac	Aac	Iac
7	Aca	Aca	Eca	Oac	NVC
8	Aac	Aca	NVC	Aac	Iac
9	Ica	Aca	Aac	Iac	Ica
10	Aac	Aca	NVC	Aac	Iac

Example 2: Human Syllogistic Reasoning

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Model Output:

Subject-ID	AA1	AA2	AA3	AA4	AI1
1	Iac	Aca	NVC	NVC	Iac
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4	Aac	Aca	Aca	Aca	Ica
5	Aac	Aca	Iac	NVC	Iac
6	Aac	Aac	NVC	Iac	Iac
7	Aac	Aac	Aca	Aac	Ica
8	Aac	Aac	Ica	Aac	Iac
9	Aac	Aca	NVC	Iac	NVC
10	Aac	Aca	NVC	Iac	NVC

Are these responses that a real human could have given?

Problem: Lacking Domain-Specific Interpretability

- Tabular data is inherently difficult to interpret (at first glance)
- Human behavioral data is even more difficult (dependent on many influential factors)

Raises interesting challenges such as how to differentiate artificial data from records obtained in psychological experiments

Goals of the Seminar

1. Investigate the properties of behavioral data (syllogistic reasoning)
   1.1 Psychological phenomena and statistical effects from the literature
   1.2 Your own data analysis
2. Devise and implement a classifier to discern human datasets from artificially generated datasets
3. Discuss the implications for working with behavioral data

Procedure

- We allow pairings of two participants
- We will provide you with git repositories
- We will provide you with training datasets (real humans and artificially generated)
- Performance will be evaluated based on predictive accuracy (proportion of correct predictions)
- No restrictions with respect to methods. Be creative!

Requirements for Passing the Seminar

1. Implemented classifier for syllogistic data (human vs. artificial)
2. Presentation (5-10 mins) of your preliminary results in our midterm meeting
   - What is your idea?
   - How does it perform based on your initial results?
   - What are your plans for improving your results?
3. Presentation (20-30 mins) of your final results in our blockseminary meeting
   - Which ideas did you follow in the end?
   - What does your final model look like?
   - How does it perform?
   - What could potential improvements look like?
   - Which insight did you gain?
4. Written report of your work (ca. 6 pages)

Important Dates

- October 30th: HisInOne registration deadline
- November 19th: Midterm presentation
- December 15th: Deadline for final models & written report
- December 20th-21st: Blockseminary

For additional information, check our website

`https://www.cc.uni-freiburg.de/teaching`

In case of questions, ask now or send a mail later

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