CERN openlab

Interpretability and Explainability as Necessary Pieces for Machine Ethics

Implementing Machine Ethics Workshop

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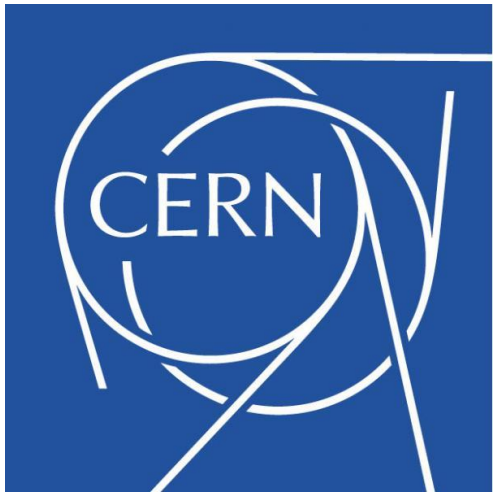
About Me

Brief Introduction

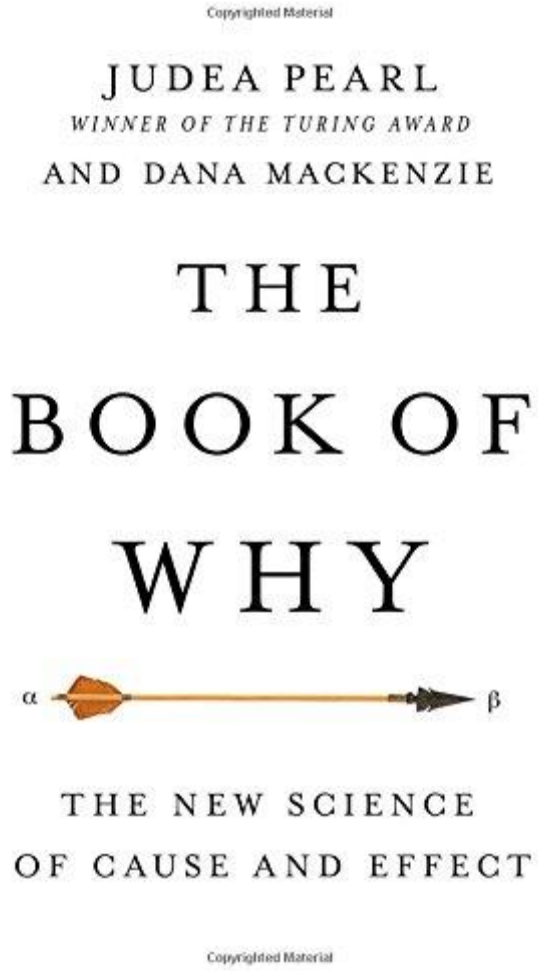


Ethics and Sustainability

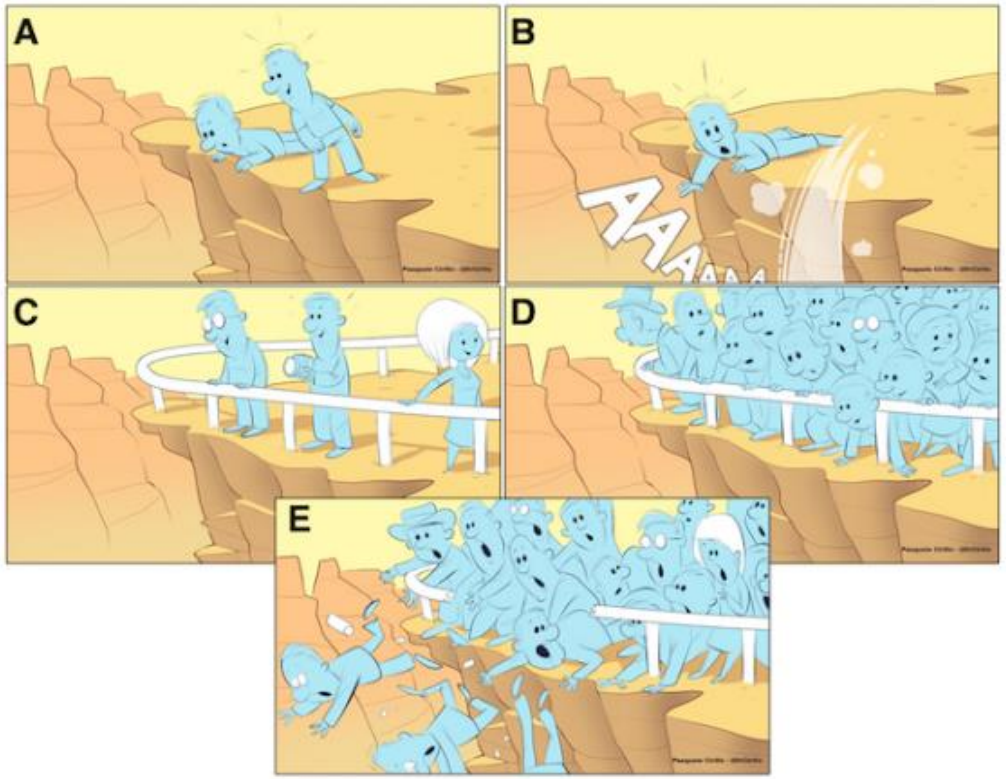
Limitations, challenges, problems

- Limited negotiation powers in decision-making
  - With Deep Learning and other recent ML-based systems
- Not all the outputs understood or explained
- Sustainability issues:
  - Need for rules and law updates constantly
- Ethical challenges:
  - Biased systems
  - Unavailability of explanations or explicit correlations

Reasonable Inference



Fences and regulations



Taken from Pasquale Cirillo's "Of Risk, Fences and unavoidable falls"

Explainable AI

- Ongoing preference towards non-"black box" models
- A paradox with recent advances:
  - Better models are available, however preferred to simpler models
- Explainability of the black box models
  - Open topic
  - Next necessary step in sustainability of Deep Learning models
  - Error correction

Explainable AI

Tendencies towards non Deep Learning approaches

Original image (dog)

Airplane	Automobile	Bird
Cat	Deer	Frog
Horse	Ship	Truck

Target classes

A White-Box Machine Learning Approach for Revealing Antibiotic Mechanisms of Action

Algorithms and Justice: Scrapping the 'Black Box'

By **Cynthia Rudin** | January 26, 2018

Explainable AI

Required characteristics

- Negotiate the inference
- Provide useful new insight from complex modelling techniques
- Meaningful human control over the systems
- Similar with scientific findings/hypothesis:
  - If a scientist produces a new theory or finding, they need to prove it and explain it
  - Same should be upheld for ML systems

Explainable AI

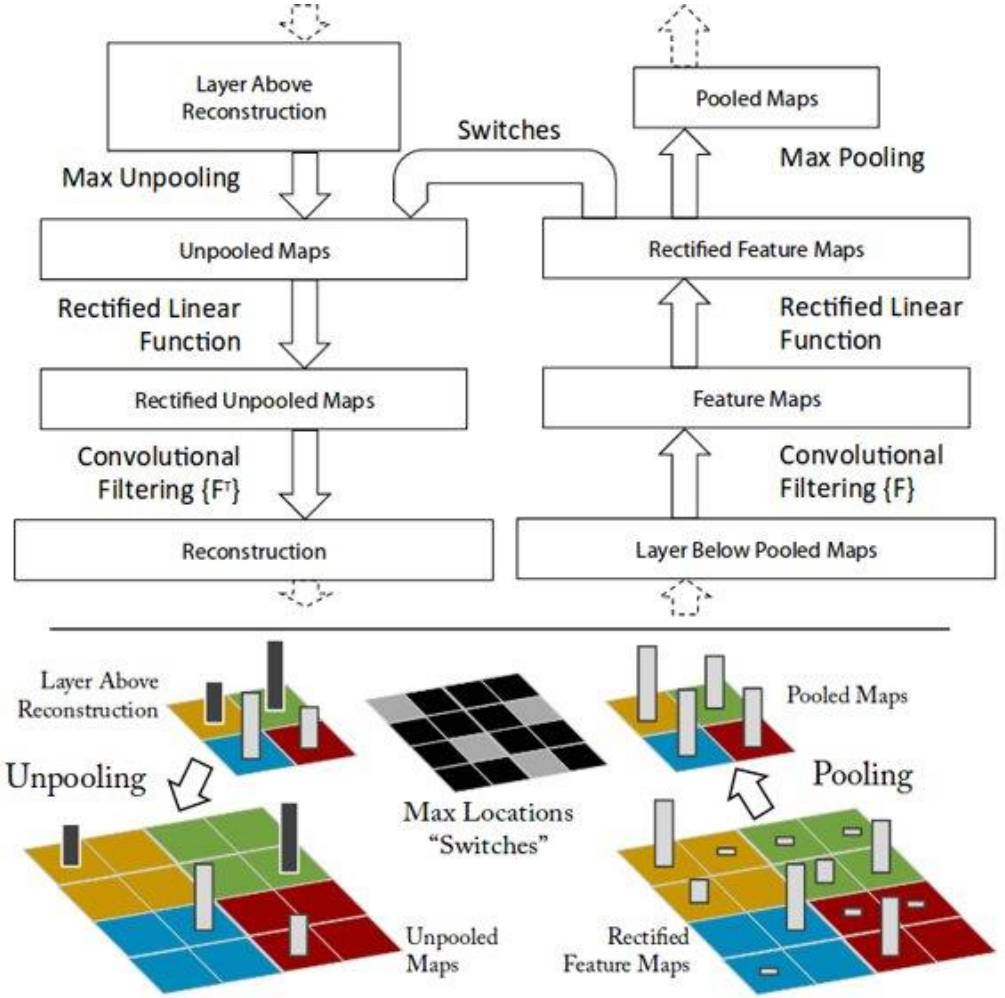
Twins UK Study together with King's College London

- A step towards interpretability and meaningful human control
- Detection of facial features in twins
  - Initially heritability analysis
  - Next clinical traits and disease symptoms
- Adaptive pipeline for deconvolution
  - Based off the work from M. Zeiler (2014)

Explainable AI

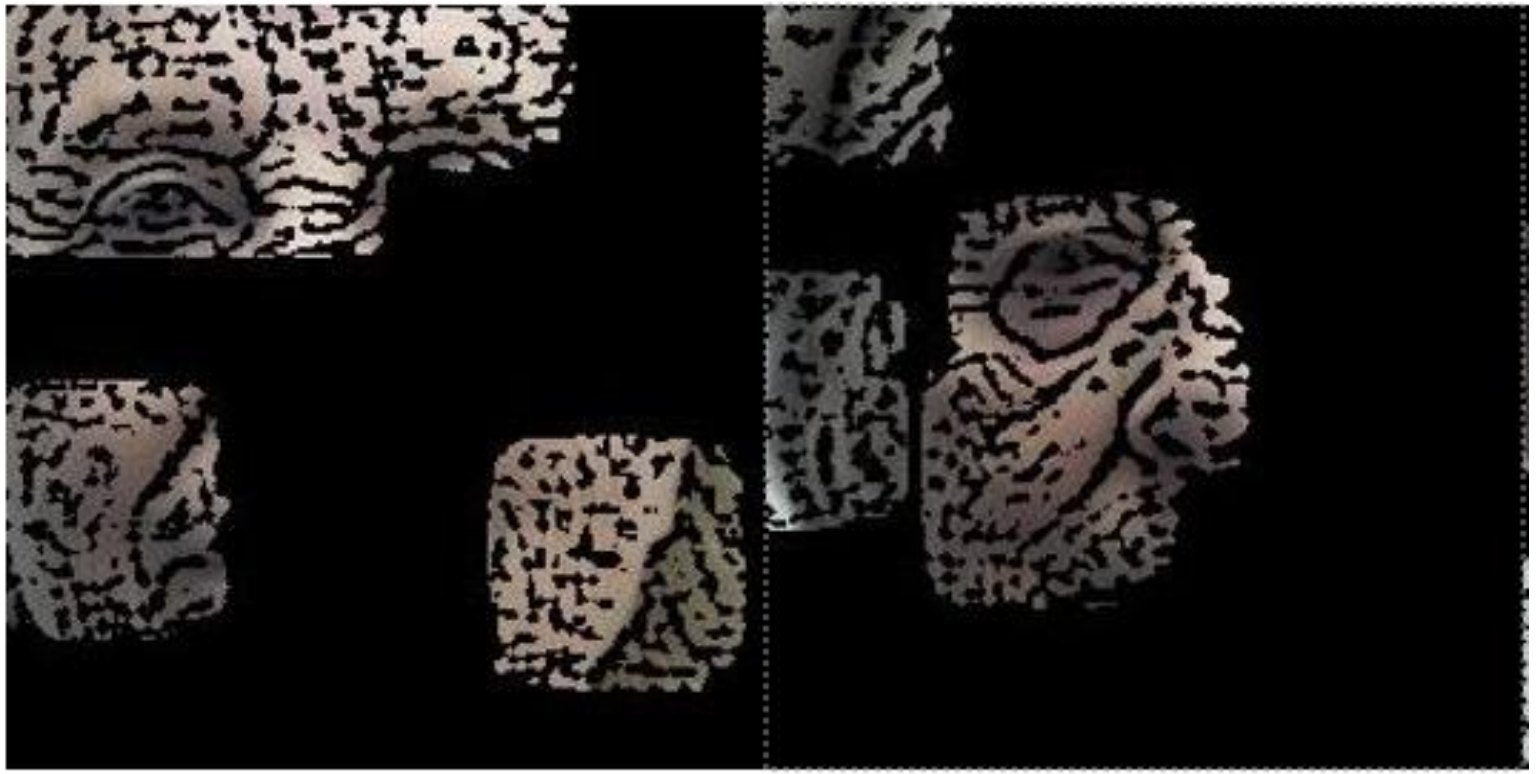
Adaptive approach for Twins UK Study

- Optimize the approach proposed by Zeiler
- Include clinical information of interest in selection of interesting neurons
- Refined approach



Explainable AI

Promising results



Limitations and expandability

- Not general enough
  - Currently, working on CNNs
- Expandability:
  - Better approximation approaches --> Exploring search space
  - Testing and adjusting for more complex networks
  - Different when comes to RNNs and attention networks
- Pro:
  - Working on pre-trained network on a general data set

Outlook and closing remarks

- Importance of Causal Reasoning
  - Cornerstone idea for the explainable AI
- Cultural difference within AI
  - Curve Fitting/Association learning vs Casual Reasoning
- TwinsUK study an important step for explainability in Medical Research
  - Practical study and example

Acknowledgement

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