

Martin's Phase 2 Contributions
and B2 Workshop
February 25, 2022



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University of Bonn



Papers

- 1 (2020) Explanations and Candidate Explanations
 - published in *EJPS*
- 2 (2021) Conjectures and Disconfirmations
 - published open access in *Erkenntnis*
- 3 (2022) Bottoms Up
 - published open access in *Studies*

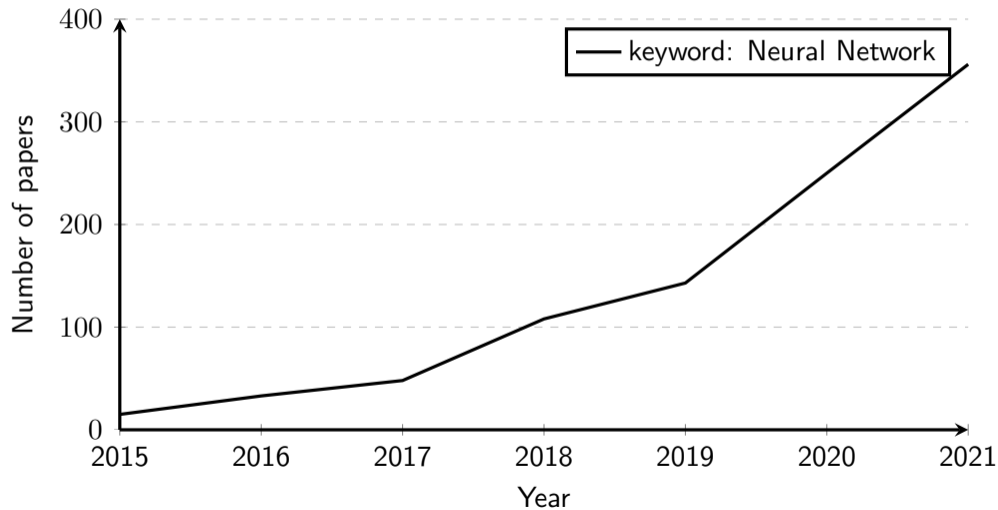
Conferences

- 1 Symposium Triple Crown (BSPS, EPSA, PSA)
- 2 Foundations of Physics



Papers

- 1 Doing More with Less: DM and MG with N. Martens (abstract accepted for chapter of Synthese Library edited volume *Philosophy of Astrophysics*)
 - looks at the debate through the lens of explanatory ideals (viz. simplicity and unification)
- 2 Abstraction, Explanation, and Effective Field Theories (?)
 - argues that EFTs are abstract models that can be explanatory when a full model is known
- 3 Realism and the Search for New Physics (*EJPS* conference edition submitting this week)
 - argues that the turn to model independence is a necessary detour, but one still wants to confirm models of realistic new physics





Guiding Questions

- what is model independence in particle physics and in general? What does it consist in and can a coherent definition be applied?
- what are the motivations for model independent strategies, and what are the prospects and drawbacks of such an approach?
- is there a reason to worry if this is not a transient mode of research?

Working Hypothesis

- MI strategies are those that aim to strongly minimise model bias
- three main strategies in HEP
 - 1 SM precision measurements
 - 2 framework for parametrising deviations (SMEFT)
 - 3 Deep Learning



Guiding Questions

- how are *model virtues* distinct from theoretical virtues?
- how are the modelling virtues changing and in virtue of what?
- how are attitudes towards principles in physics changing, in particular, the principle of naturalness?
- what will guide model-building going forward?

Working Hypothesis

- theoretical virtues are about acceptance/truth, but the virtues of a good model are more i) about pursuitworthiness, ii) more local, iii) non-epistemic
- principles (e.g. naturalness) are more like guides and attitudes towards them change over time (pursuitworthy)



Guiding Questions

- in what sense are Deep Neural Nets black boxes?
- can black boxes explain?
- can we explain the success of DNNs and how can DNNs explain?
- do the features of the set of training data function similarly to modelling assumptions?

Working Hypothesis

- the blackboxing in DL algorithms does not preclude, but severely restricts the range of answers to explanation seeking questions



Guiding Questions

- what is the role of theory/model in DL searches for new physics?
- can DL searches be thought of as employing an inductivist methodology?
- is this strict inductivism possible, and what are its advantages and disadvantages?

Working Hypothesis

- it is as close as we can get to pure empiricism, but
- researchers are turning to more inductivist methods primarily because they have few other options, not because they think these are more likely to be successful



Guiding Questions

- how does data travel through DNNs in particle physics?
- how does this relate to other pictures of *data journeys* and other characterisations of particle physics measurements?
- what is the role of representation in this process and how does this affect our ability to understand?

Issues

- opens innovative approaches to data representation (image recognition)
- analyses closer to data (rather than on particle four-momenta MEM) reduces reliance on models
- issues of training on real data—no true labelling



- what is 'model independence'? How independent from models can one be?
- how does one historically, or philosophically, characterise the methodological shift that is happening?
- have there been other time periods during which physicists pursued model independence? what relation does this bear to today?
- why pursue model independence? what are its benefits and limitations?
- in what various ways are physicists reducing dependence on models, modelling biases, and modelling assumptions?
- how do deep learning and AI searches fit with model independent strategies?
- etc.



- June 14-15 in Bonn
- Senatsaal
- Hybrid
- 1-2 slots for short contributed virtual 'poster session' (10min)

Speakers

- Michelangelo Mangano
- Christophe Grojean
- Kyle Cranmer
- Philip Bechtle
- Michela Massimi
- Emily Sullivan
- Adam Koberinski
- Richard Dawid