ML @ Nikhef

Theory group

Current situation

- 'Theory' is a broad field, major impact is difficult to assess, but can be found in e.g.
  - Data fitting (PDFs, SMEFT, WEFT, shape functions); both NNs but also GNN/transformers/symbolic regression
  - Jet substructure, tagging (NNs)

- People in the group are generally not using ML/AI, except for Juan Rojo (and his group), who are mentioned as the in-house experts by everyone

- Staff members had a handful of bachelor and master students exploring ML applications

- People are starting to use ChatGPT, CoPilot etc and would like to have Nikhef support to keep on doing this and ensure data protection

- Current infrastructure is deemed be sufficient (by Juan)

Future

- Expected techniques with impact:
  - Simulation-based inference
  - Generally unsure

- Helpful tools to have (with big impacts):
  - 'minus-sign and factors-of-2 finders'
  - ML-assisted code optimization (both private, but also e.g. FORM)

- In general questions were found to be too detailed, as experience with ML/AI is very limited and also not on the radar of most

- In general people would like to have support in the form of a joint PhD student to explore new ML/AI opportunities

- Quantum computing, although not part of survey, was mentioned too (in context of lattice QCD, non-perturbative modeling). These problems are big and certainly, in case of lattice QCD, having unlimited computational power would help getting answers