Playing the devil’s advocate with hidden systematic uncertainties

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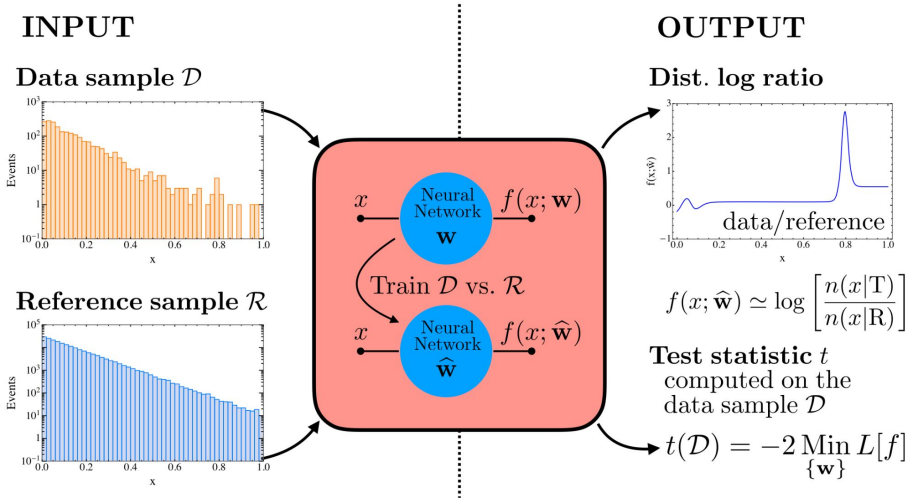
Anomaly detection and…

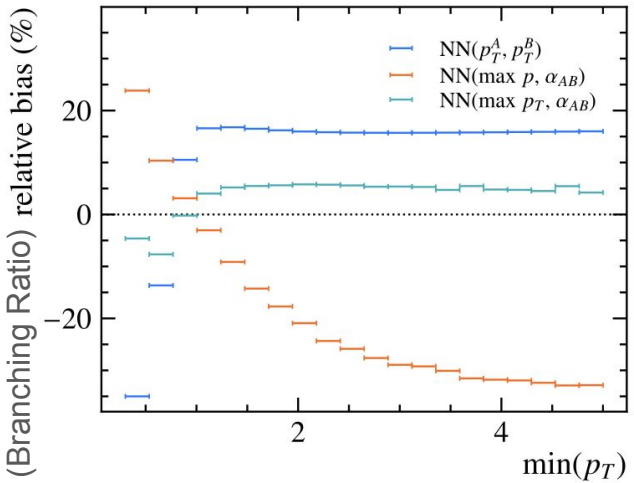
- Use machine learning to find agreement between standard model data and the detector data
- Turn the coin:
  - You think you found new physics!
  - Let's play the devil's advocate for the standard model and find the systematics which caused this "new" physics



arxiv:1806.02350

Efficiency mismodelling

- Starting from a signal vs background classifier
- Using NNs and Linear Programming, within some set constraints, mismodel the efficiency
  - by maximizing misid
  - This changes results!



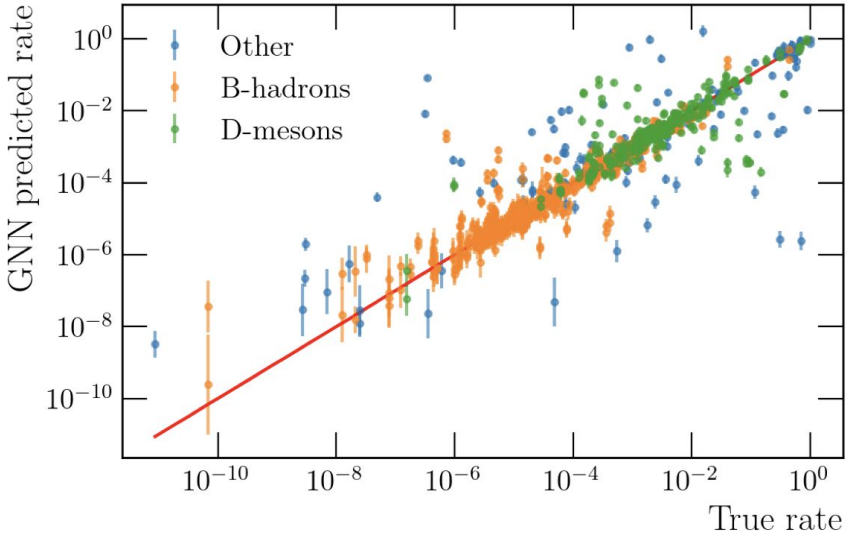
arXiv:2303.15956

Next step: Find the backgrounds

- High number of combinatorics in hadronic decays
- Analysis takes years to complete
- Can still miss systematic factors
- Finding the decay modes which are problematic for an analysis

Relevance: Branching ratio $\times$ kinematic overlap $\times$ mis-ID

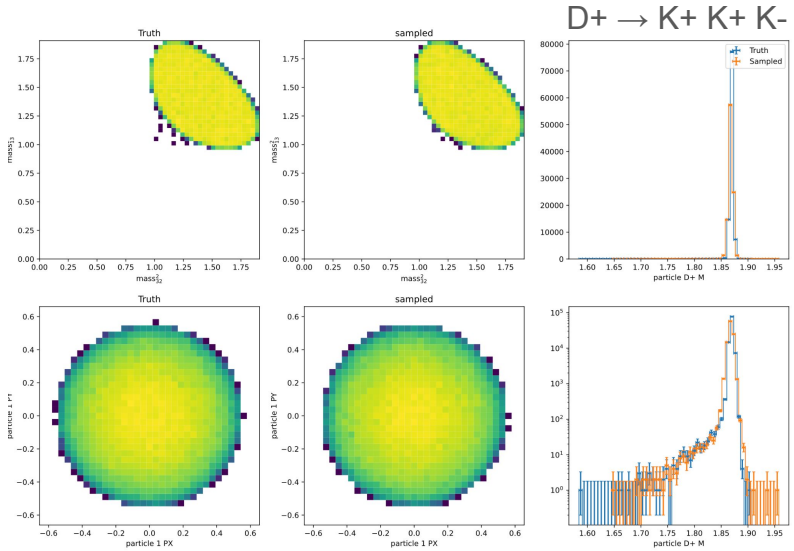
Branching ratios

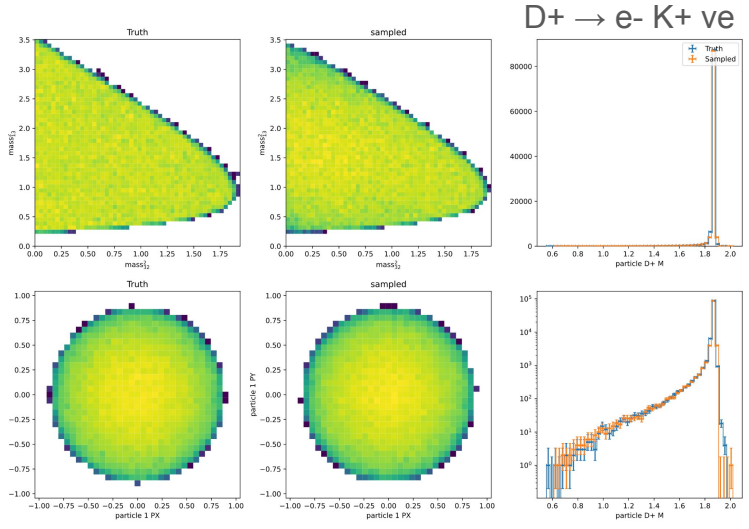


Can we generalize from DECAY.dec to other unmeasured modes?

Simulation or replacement!

- Learn on fast simulator (something like RapidSim)
- Transport or transfer the distribution to full detector





A very very simple NN can learn many decay modes (10 here)

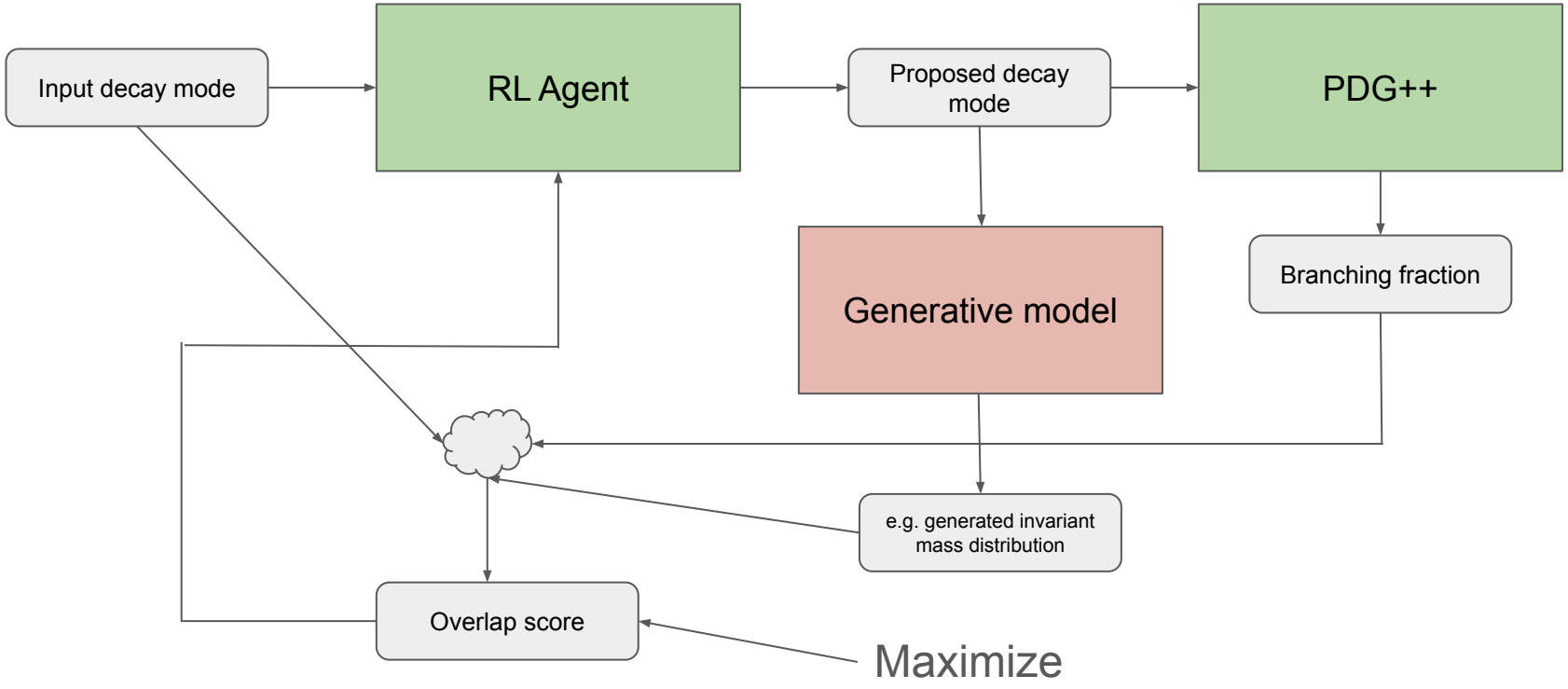
Putting it together!

- Need some fancy search algorithm
  - Reinforcement learning?
- Query different decay modes
  - taking the relevance score as its reward
  - and present to us the most problematic decay modes
  - including the ones which we might have missed and we need to consider!

- Extension to this approach can likely also be used for other problems in physics as well

Extras

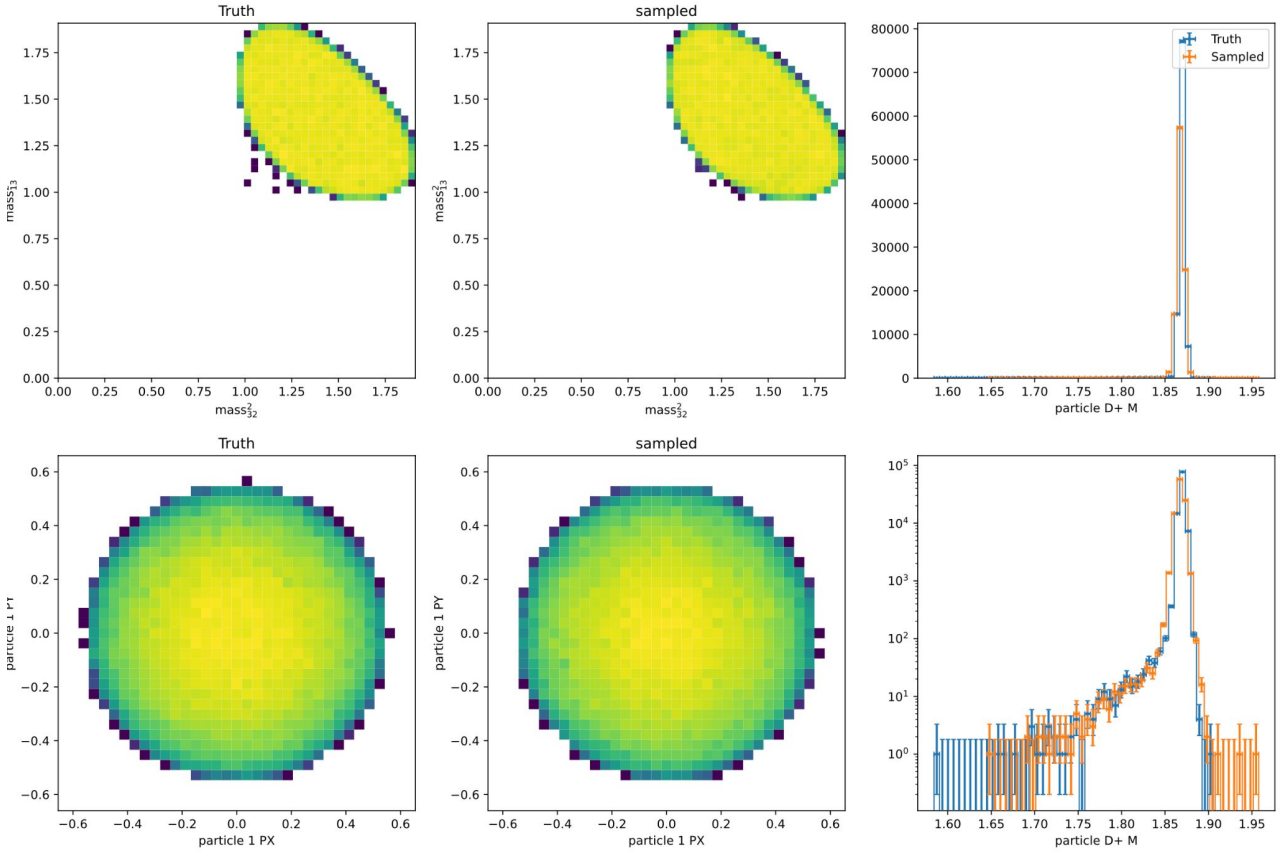
Deep Learning Advocate



New results

411 to

321 321 321



Other collaborators

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