NEURAL MPC: SYVILLÄ NEUROVERKOILLA KETTERÄSTI JA LUOTETTAVASTI DATASTA SÄÄTÖÖN

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Deep neural networks

DEEP LEARNING EVERYWHERE







INTERNET & CLOUD

Image Classification Speech Recognition Language Translation Language Processing Sentiment Analysis Recommendation

MEDICINE & BIOLOGY

Cancer Cell Detection **Diabetic Grading Drug Discovery**

CURIOUS AI

MEDIA & ENTERTAINMENT

Video Captioning Video Search **Real Time Translation**

SECURITY & DEFENSE

Face Detection Video Surveillance Satellite Imagery

AUTONOMOUS MACHINES

Pedestrian Detection Lane Tracking Recognize Traffic Sign



Neural MPC

Deep Neural Networks



Planning

CURIOUS AI

Adaptive optimal control

Example: target customer temp 80 °C



CURIOUS AI

Customer temperature

Example: target customer temp 80 °C



CURIOUS AI

Output temperature of power plant

Example: target customer temp 80 °C





CURIOUS AI

Output temperature of power plant

Predictor structure



















CURIOUS AI

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Delays, nonlinearities, complex sequences and change

Actions taken in the beginning of the process...



... have measurable consequences at the end of the process





Action suggestions: what happens?

1. We pre-define a profit function

(though it helps if it's continuous)







Planning with learned models \rightarrow problems

Goal oriented

Find actions which are predicted to give the best results

Planning

Optimize plan for future controls to achieve arbitrary goal

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Operator advisor or closed-loop control





Combine imitation and understanding

Goal oriented

Find actions which are predicted to give the best results

Imitation

Favour actions which are familiar = learn to imitate past behaviour

Planning

Optimize plan for future controls to achieve arbitrary goal

Operator advisor or closed-loop control





Main benefits

- Improves stability, increases throughput, saves energy
- Recovers faster from problems
- Controls many variables simultaneously
- Can plan and execute sequences
- Data-driven: easy to deploy and maintain

Thank you! harri@cai.fi



