Trustworthy AI for Power Systems

Tutorial Lecturers:

Baosen Zhang, Univ. of Washington

Pascal van Hentenryck, GeorgiaTech

Priya Donti, MIT

Sam Chevalier, Univ. of Vermont

Spyros Chatzivasileiadis, DTU

Spyros Chatzivasileiadis
Professor
Head of Section Power Systems
Technical University of Denmark (DTU)

What are your main takeaways from the Tutorial ?

- Add your keywords as we go!

- **What do you want to remember after Friday?**
  Submit it as phrase or keyword! It might be important for others too!

http://www.chatziva.com/pscc2024.html

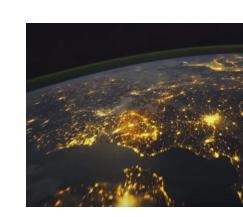Note your Takeaways
as we go!
Join at menti.com
Use Code: **1858 6971**

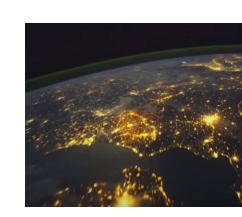# But: Would you ever trust AI to run your electricity network?

But: Would you ever trust AI to run your electricity network?

If it is trustworthy AI, maybe!

Some Final Thoughts

- **If we want to accelerate processes by 10x-100x-1000x we need to think differently**
  - Conventional methods reach their limits (?)
  - Could AI become the disruptive technology?

- AI is already creating value for applications where there is no other good option, e.g. forecasting
  - Still, we need interpretable/explainable AI for those cases

- **AI could potentially be disruptive for energy systems if it becomes trustworthy**
  - We need standards and AI certification
  - Tradeoff between AI size and interpretability/trustworthiness

Trustworthy AI for Power Systems: Some thoughts on the Vision

Example (and there are several others)

AI Testing and Experimentation Facility for Energy

- Establish a platform that verifies AI tools and certifies that they comply with power system safety specifications

AI-EFFECT EU project

Start: 1st October 2024

Participants: EPRI (Lead), DTU, TU Delft, Univ. Porto, BEOF, TenneT, ENEL, and others

AI Standards: Create Standards for AI tools in Energy

Wrap-up

- **ML proxies: Machine Learning can accelerate by 10x-100x power system computations**

  – Machine learning surrogate models for power system (stochastic) optimization

  – Physics-informed neural networks for power system dynamics

  – Once trained, they can run on a laptop

- **Trustworthy AI: Correct-by-design**

  1. **Design** the structure of the ML/RL model so that it can offer guarantees

  2. **Train** the ML/RL model so that it offers guarantees (e.g. use implicit optimization layers and include the constraint violation in the training)

  3. **Verify** the ML/RL models after training

Wrap-up

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  - Machine learning surrogate models for power system (stochastic) optimization
  - Physics-informed neural networks for power system dynamics
  - Once trained, they can run on a laptop

- **Trustworthy AI: Correct-by-design**
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Let's work together on rigorous, reliable and trustworthy AI methods for power systems!

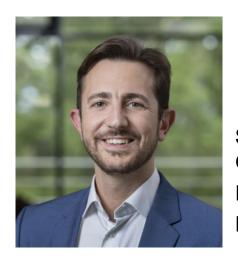# What do you want to remember after Friday from this tutorial?

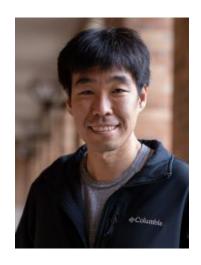80 responses

Many thanks to our speakers!

**Pascal
van Hentenryck**
Professor
GeorgiaTech

**Sam
Chevalier**
Assistant Professor
Univ. of Vermont

**Spyros
Chatzivasileiadis**
Professor
DTU

**Baosen
Zhang**
Associate Professor
Univ. of Washington

**Priya
Donti**
Assistant Professor
MIT

**Thank you very much all for participating
and for the very nice discussion!**

Equality, diversity and inclusion (EDI) in the power systems community

Britta Buchholz
Hitachi Energy

Marco Reggiani
University of Strathclyde

Gabriela Hug
ETH Zurich

Keith Bell
University of Strathclyde

The roundtable will bring together Academic and Industrial experts to discuss Equality, Diversity, and Inclusion (EDI) within the power community. The debate will encompass a broad spectrum, including gender, sexual orientation, disability, and other relevant aspects. Experts will share their personal journeys, explore the latest EDI research in the energy sector, and highlight ongoing EDI initiatives. Attendees are encouraged to engage, ask questions, and present their own EDI experiences and actions within their organisations.

Starting at 17.00!

Moderated by:

Biljana Stojkovska
BP

Agusti Egea-Alvarez
University of Strathclyde