

Advancing Spectrum Science: Rely on Domain Knowledge or Handoff to Machine Learning Models?

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Domain vs ML

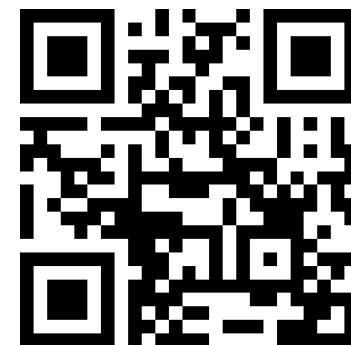
- Spectrum science and engineering is not a **blank slate**; it comes with decades of regulation, industry/government activities, and evolving R&D.
- ML models (esp. gen AI) can be powerful, but without domain knowledge, they risk being brittle, inefficient, or even misleading.
- The real opportunity is not “domain vs. ML,” but “**domain + ML.**”

What may work now?

- Use domain knowledge to **pre-train** large gen AI model
 - Grounded priors
 - Trust and interpretability
- Use ML to refine, adapt, or augment AI model
- This “**physics-informed ML**” is already transforming other fields (materials, biology), and spectrum science can similarly benefit from this paradigm
 - Telecoms will adopt AI faster if it builds on trusted engineering models

What can we do next?

- Need to have deeper discussions with AI/ML experts
 - AI/ML experts lack an understanding of the unique physical, algorithmic, and architectural constraints in spectrum engineering
 - Wireless researchers tend to adopt generic, off-the-shelf AI/ML models not optimized for the intricacies of spectrum engineering
- We are organizing the first-ever **AI for wireless workshop** at this year's **NeurIPS**, one of the premier ML conferences
 - Bring wireless to the doorstep of AI/ML
 - Both AI/ML and wireless researchers, both academia and industry



Are we (spectrum researchers) ready for AI?

- Understanding and embracing the potential of AI/ML
- We often say “AI-native”, but do we really have that mindset?
- Fragmented spectrum data (both low and high level) and problem-specific ML models are a big bottleneck
- Workforce dev: spectrum science needs a new generation of engineers who are bilingual in AI/ML and spectrum