
# Deep learning, remote sensing, and utility transmission and distribution asset intelligence

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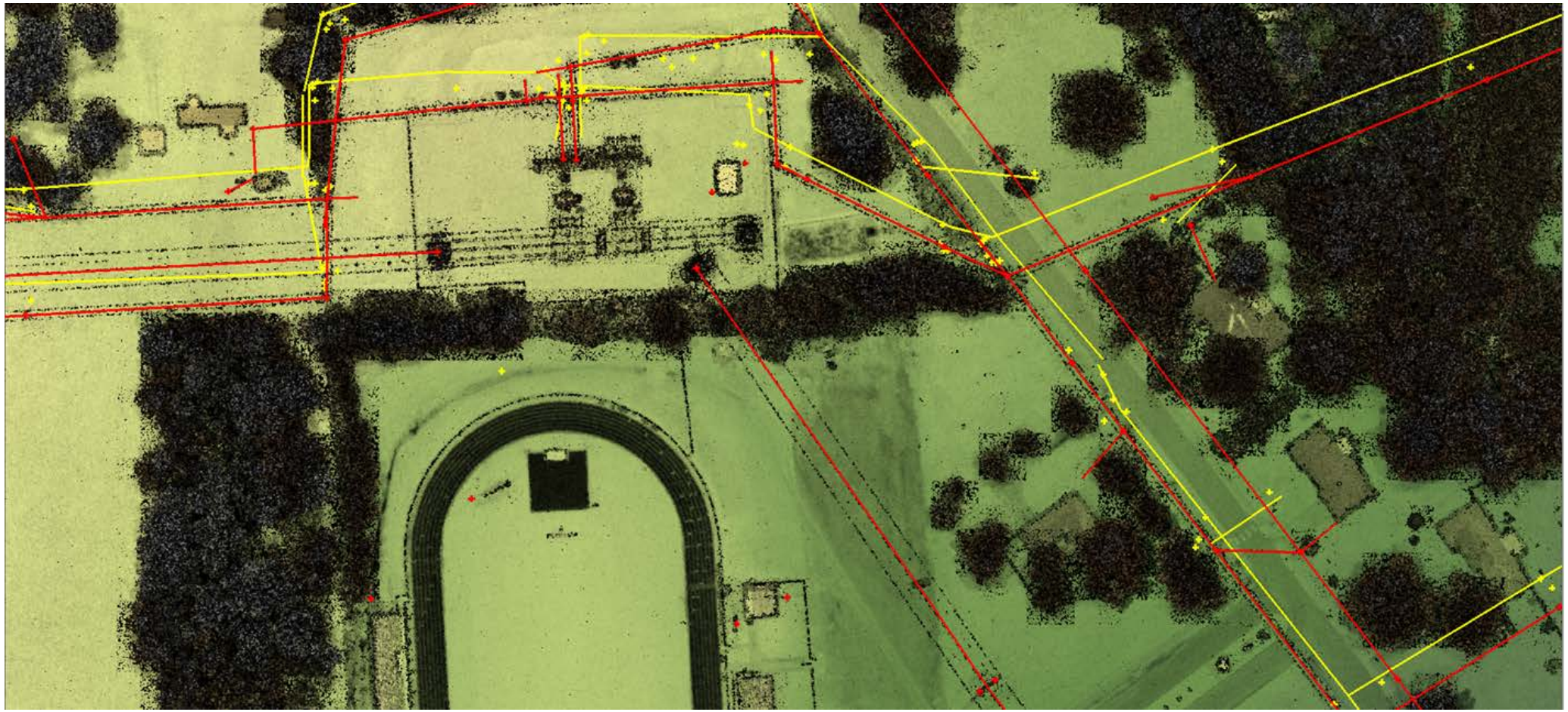
# Outline

- Remote sensing opportunities in utilities inspections
- Deep learning as a tool to improve remote sensing outcomes
- Challenges in using deep learning in utilities
- Strategies for overcoming these

# Remote sensing opportunities in utilities

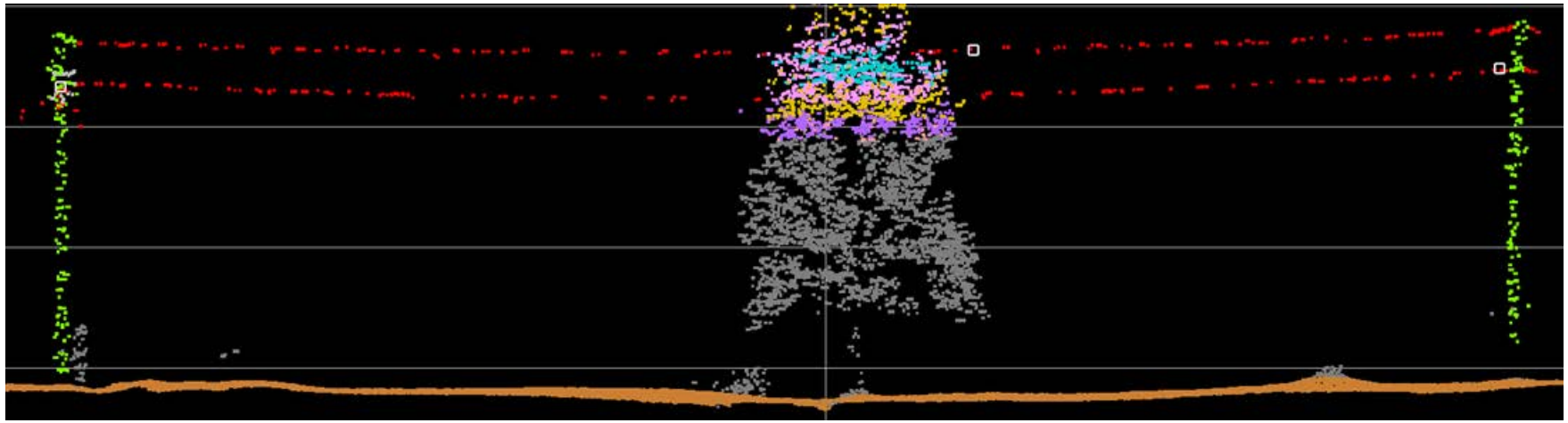
- Benefits
  - Safety
  - Leverage improving economics of collection
- Applications
  - Pole location update and conflation
  - Vegetation management
  - Asset management – inventory, health checks
- Commonality with other areas
  - Substations, solar farms, wind turbines, pipelines, rail, etc.

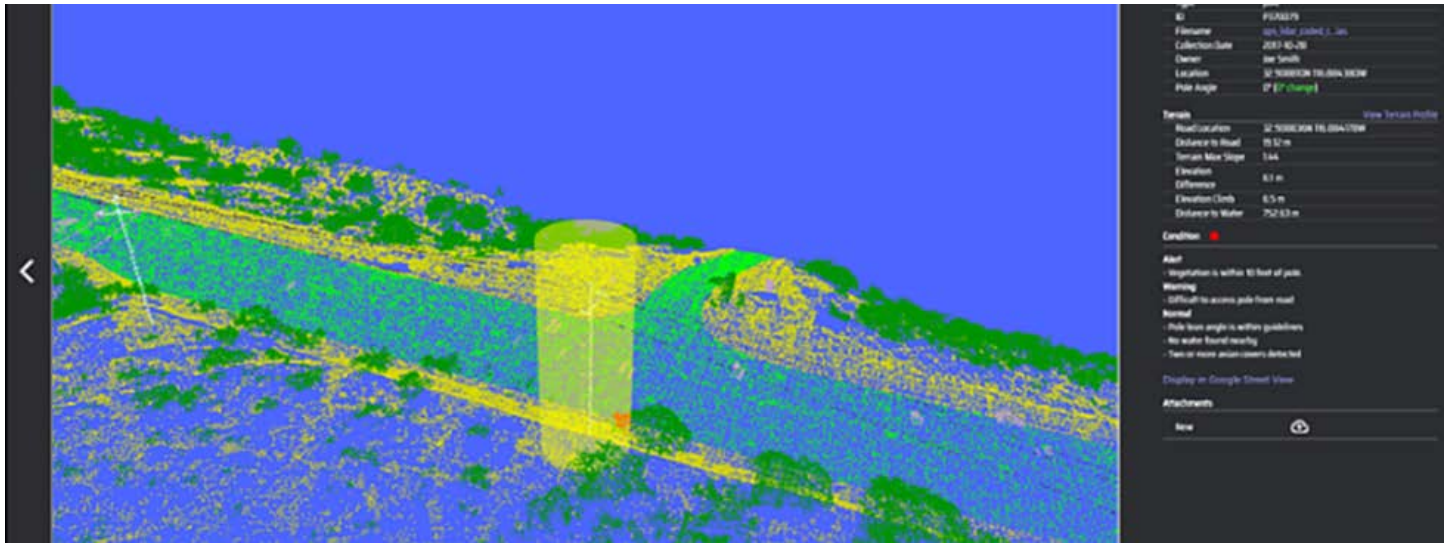
# Opportunities – pole location update



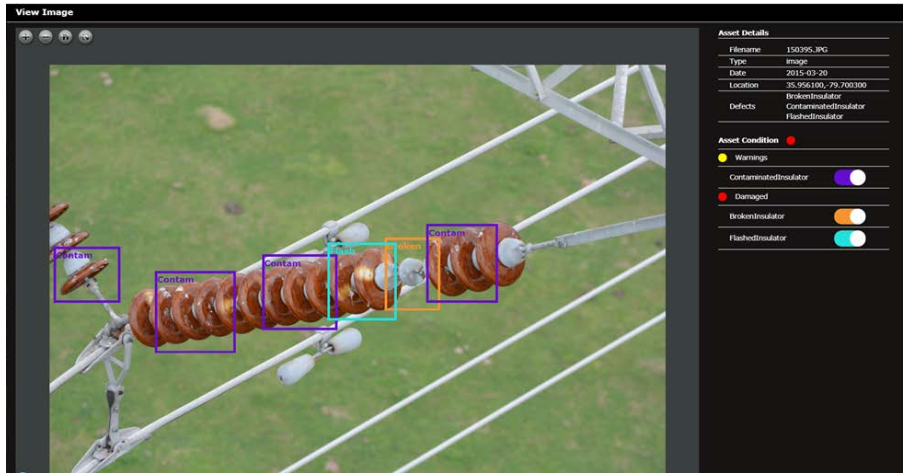
Red linework indicates new improved asset locations after conflation using L3Harris Geiger-mode lidar

# Opportunities – vegetation management

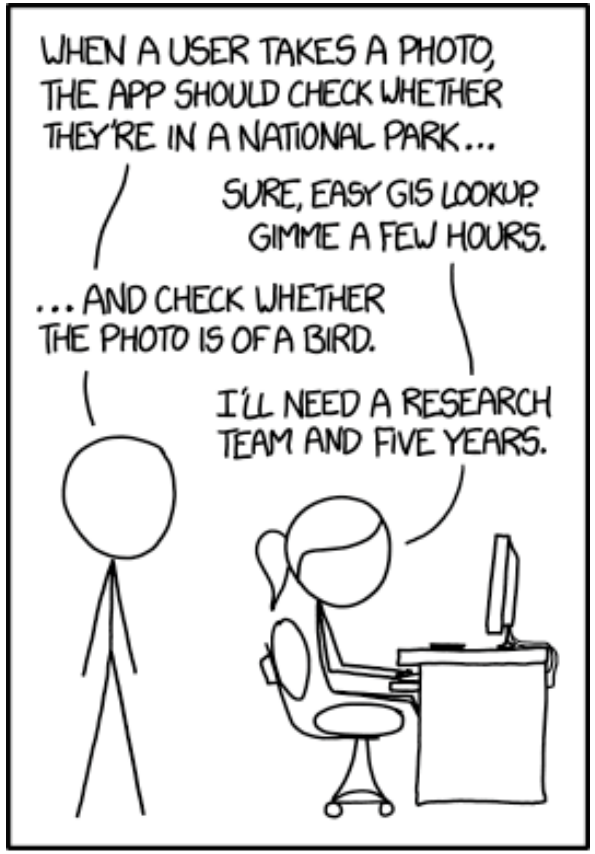




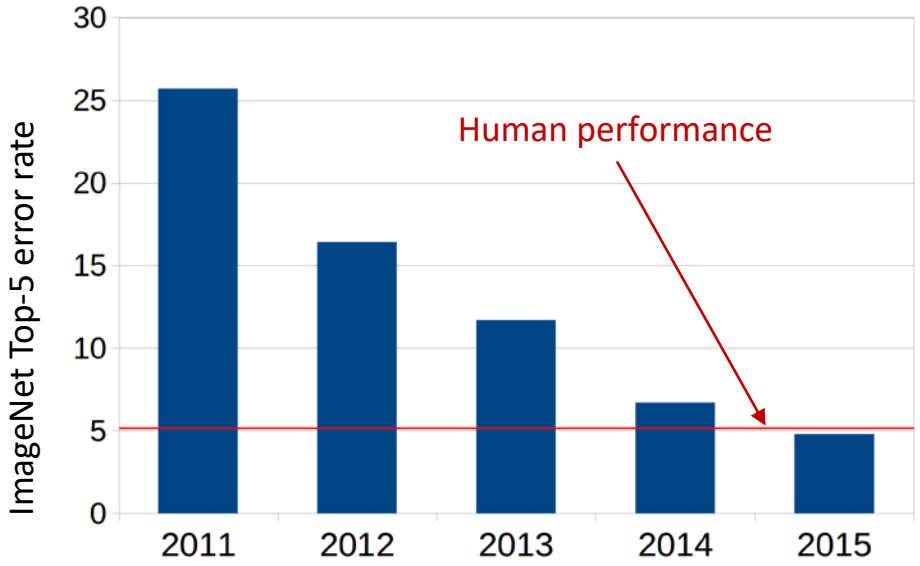
# Opportunities – inventory and health checks



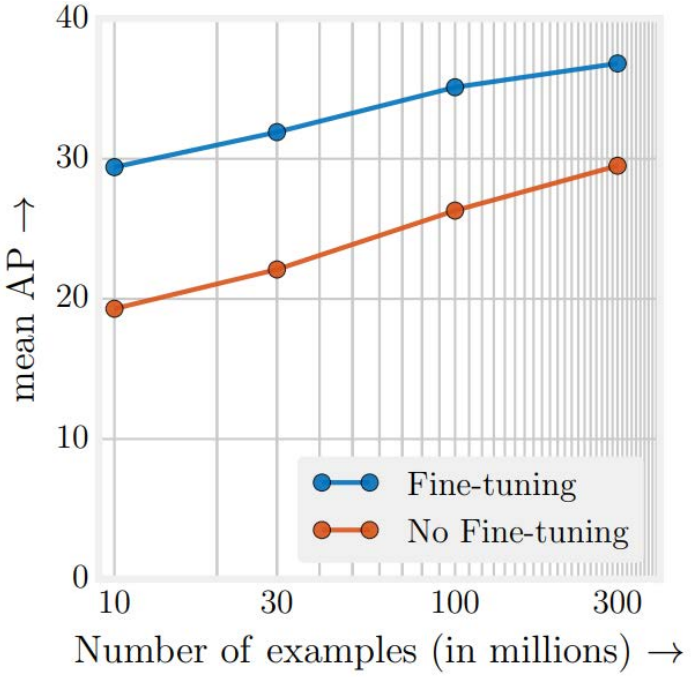

# Deep learning performance – cleverness and data




xkcd 1425




Wikicommons (CC0 1.0)




Revisiting Unreasonable Effectiveness of Data in Deep Learning Era (Google, CMU). arXiv:1707.02968

# Challenges

- Fragmented data holdings; examples of defects are rare
- Sensitive and restricted data
- Inspections are comprehensive and ‘bundled’

# Challenges & Strategies

- Fragmented data holdings; examples of defects are rare
- Sensitive and restricted data
- Inspections are comprehensive and ‘bundled’

- Aggregate data in repository and include data collection in work flows
- Share data – with safeguards
- Add value within existing inspection workflow
- ~~Cheat!~~ Make the problem easier

# Strategy – aggregate data

- A central repository helps sharing within an organization.
- In some utilities, certain infractions require an image with the remediation work order.

- Aggregate data in repository and include data collection in work flows
- Share data – with safeguards
- Add value within existing inspection workflow
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# Strategy – share data across industry

- Medical and defense as models for handling sensitive data
- EPRI

- Aggregate data in repository and include data collection in work flows
- Share data – with safeguards
- Add value within existing inspection workflow
- ~~Cheat!~~ Make the problem easier

# Strategy – add value within existing workflows

- Back-office inspections
- Start with semi-autonomous. Build trust.
- Roadmap to continuous improvement

- Aggregate data in repository and include data collection in work flows
- Share data – with safeguards
- Add value within existing inspection workflow
- ~~Cheat!~~ Make the problem easier

# Strategy – make the problem easier

- Collection protocols and repeatable collections
- Use more data (example: autonomous cars)
- Aggregate data in repository and include data collection in work flows
- Share data – with safeguards
- Add value within existing inspection workflow
- ~~Cheat!~~ Make the problem easier

# Summary. Questions?

- Remote sensing can help make utilities inspections more efficient and safer.
- Deep learning is a useful tool – even before a capability is at human-level.
- Aggregate data naturally, look for ‘piggyback’ opportunities
  - Across industry, across departments, integrate image capture and retention into work flows
- Make the problem easier while still adding value
  - Collection protocols, fit into workflows, use additional data