Science Showcase: Technology

By: Esmaeil S. Nadimi
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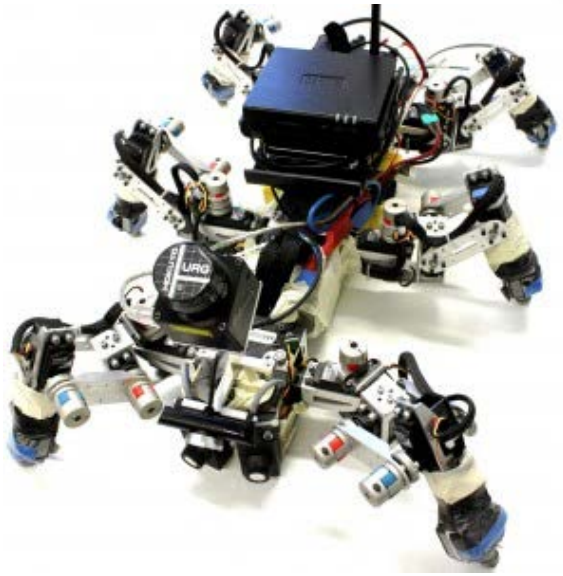
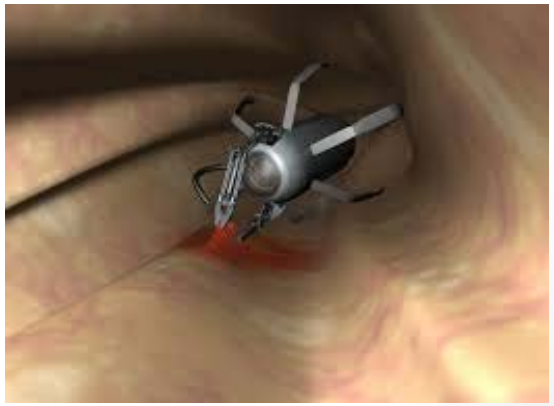
Field of Research

- Embodied AI and Neuro-robotics
  - ✓ Locomotion, Object manipulation and navigation
  - ✓ Miniature medical robots
- Bio-robotics and Bio-inspired robotics
  - ✓ Brain-Machine interface
  - ✓ Human-Robot interaction
- Machine Learning & Signal Processing
  - ✓ Big Data analytics
  - ✓ Artificial Intelligence (Deep Networks)






Wind Turbine Fault Detection

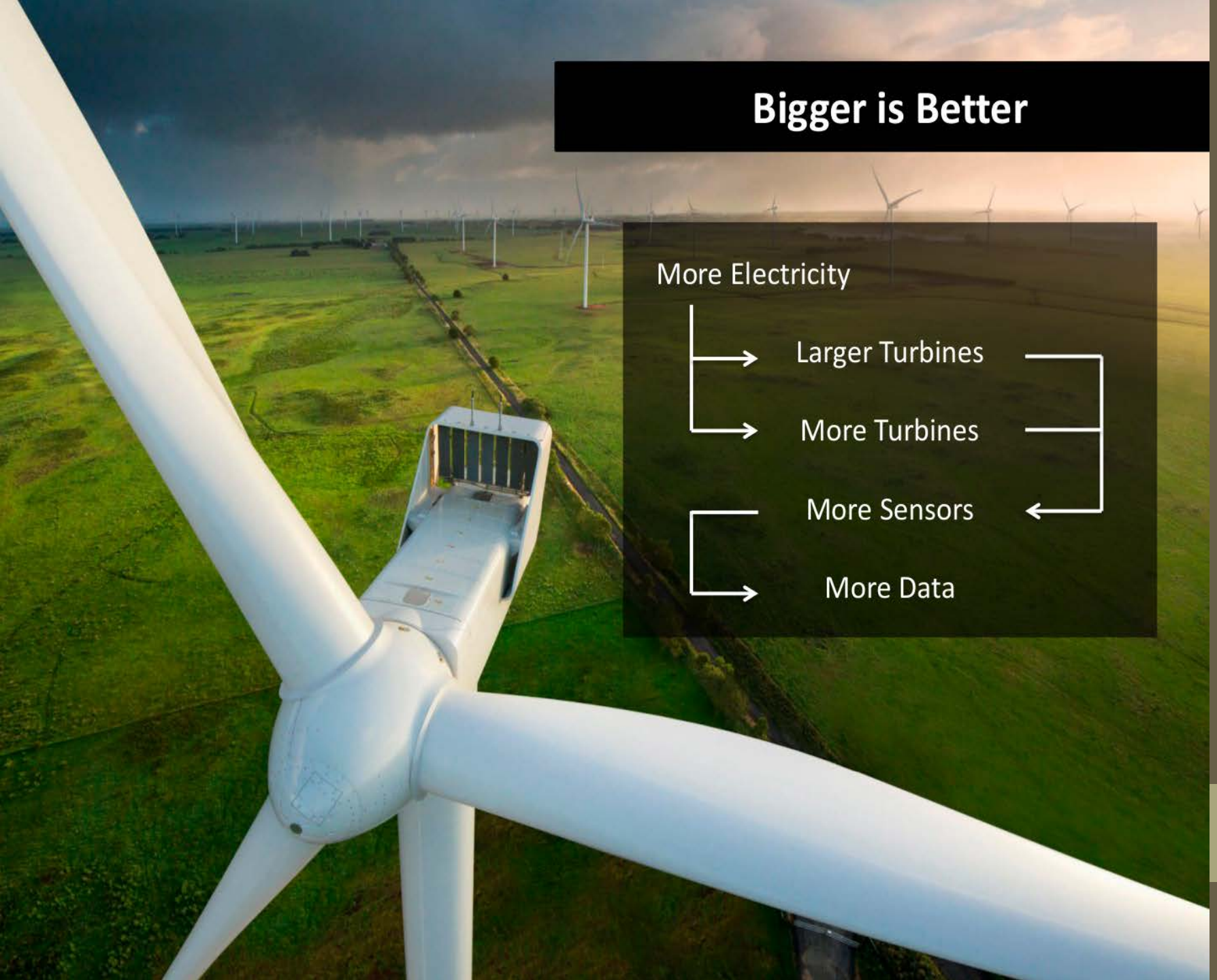
Turbine Failure

- Wind turbines do fail:

1. Degradation
2. Poor manufacturing
3. Inappropriate control
4. Environmental impact

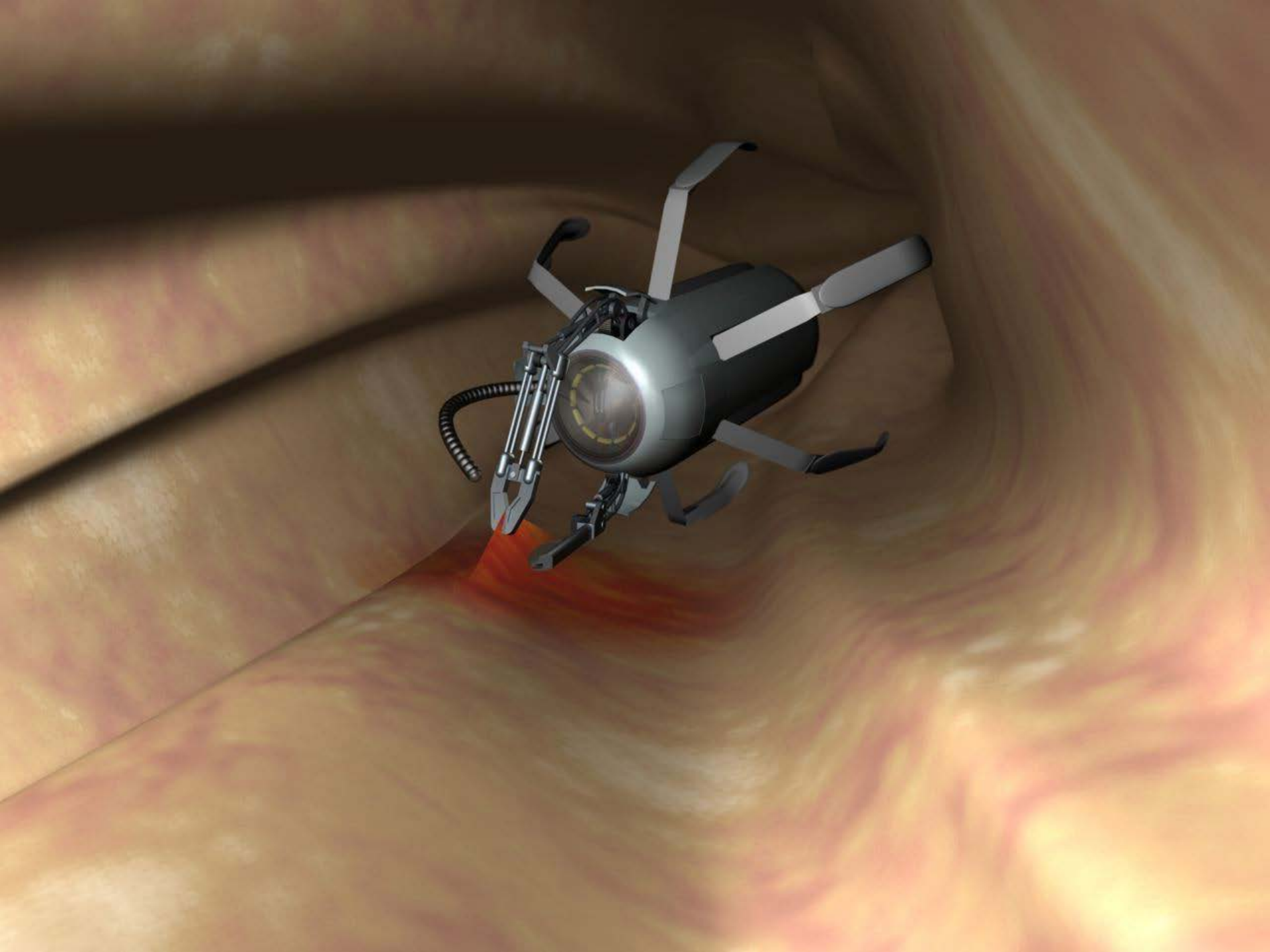
- Fault Prediction:

Minimizing costs of operation and maintenance of wind turbines


Bigger is Better
More Electricity
Larger Turbines
More Turbines
More Sensors
More Data

Abacus

- Machine learning algorithms and big data analytics for detection of state transition during the life-span of turbines
- MATLAB / Parallel Computing Toolbox + Machine Learning and Statistics Toolbox
- Execution:
  1. Load the model and initialize pools
  2. Set up iterations
  3. Switch all workers to a temporary directory for file handling
  4. Loop through iterations and compute parameters
  5. Switch all workers back to the root directory to combine the results



FUTURE:

An Effective Colorectal Cancer Screening Program based on Novel Dual-Mode Wireless Endoscopic Capsules

Aim & Objectives

To rethink the current standard colorectal cancer (CRC) screening program and significantly improve the efficiency in terms of accuracy, acceptability, reduced complication rate and cost effectiveness.

9 OUT OF 10 Colon Cancer Found In The Early Stages Has A Survival Rate As Great As 90%

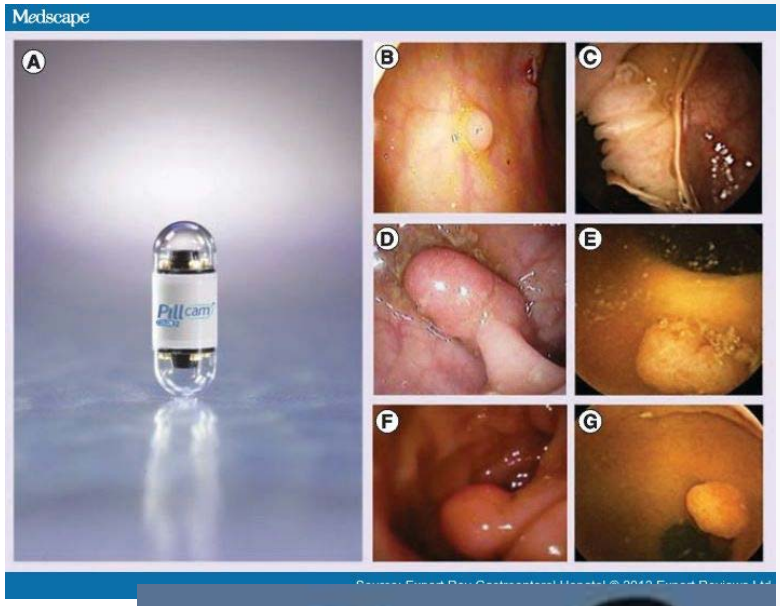
Camera pill

- **Pros:**

1. Acceptability
2. No risk of complications
3. Outperforms colonoscopy and iFOB test in both sensitivity and specificity

- **Cons**:

1. Uncontrollable
2. No narrow band imaging (NBI)
3. White light imaging (WLI)
4. No intelligence
5. Needs to be administered at the hospital
6. Inaccurate polyp size estimation



EFFICACY is the solution

- Shortcomings in hardware:
  1. Imaging unit
  2. Processor unit

- Shortcomings in software:
  1. Objective measure of bowel cleanliness and preparation
  2. Reliable measure of polyp size (important risk factor influencing treatment and follow up decisions)
  3. Autonomous real-time recognition and characterization of histological properties of polyps
  4. Recognition of inflammation.

Abacus

- Machine learning algorithms and big data analytics for polyp detection, classification and characterization
- Each camera pill produces up to 500,000 images / patient
- Each year, approximately 130,000 patients will go through screening
- Two strategies to address the issue:
  1. State of the art ConvNets, RNN
  2. Train and build our ConvNet from Scratch

- MATLAB / Parallel Computing Toolbox + Machine Learning and Statistics Toolbox + Image Processing Toolbox

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