Deep Neural Networks for Rapid Fault Detection in Marine Hydrokinetic Turbines

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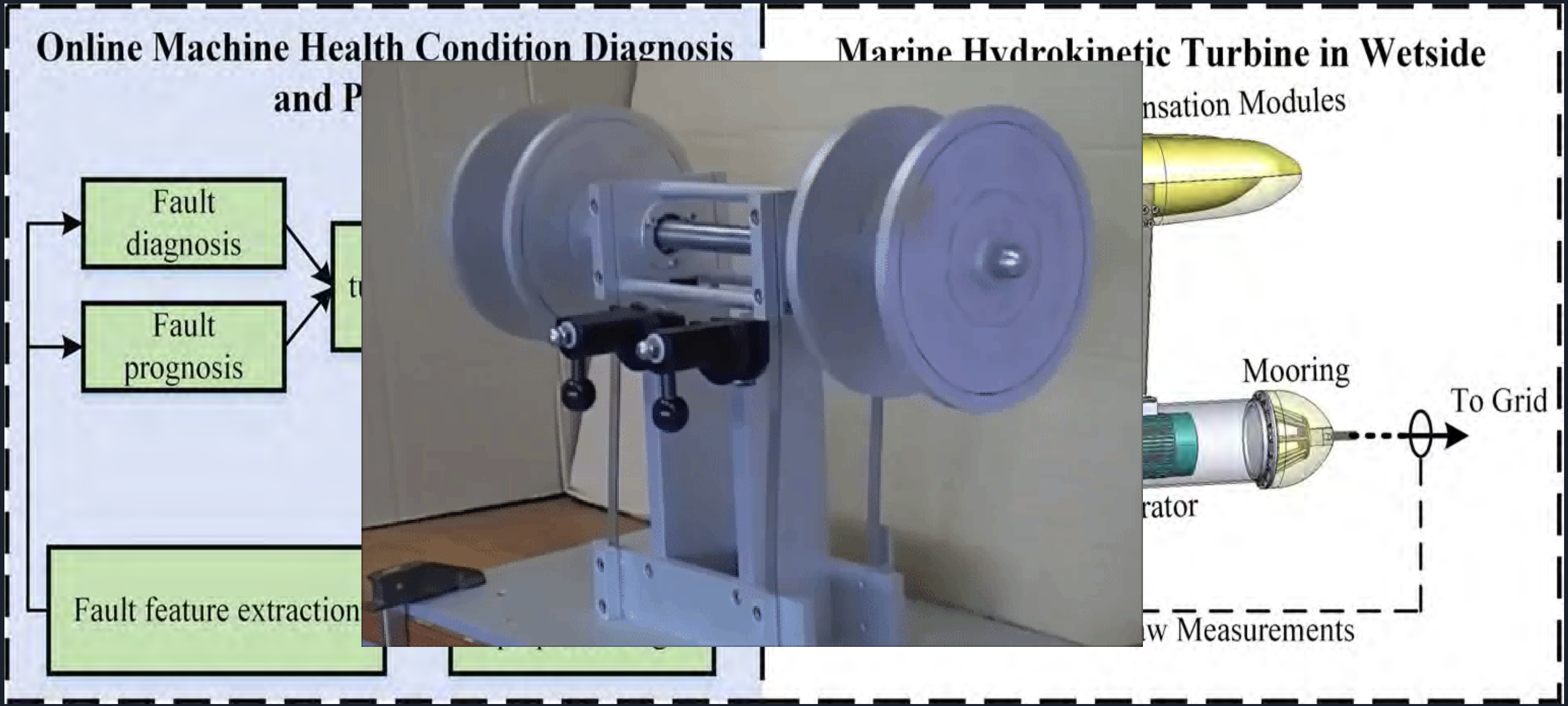
The Problem

- MHK has a high Levelized Cost of Energy(LCOE)
- LCOE for MHK is approximately 18% Operations and Maintenance (O&M)
- O&M cost reduction with Neural Networks can increase MHK viability

The Framework



Source: https://www.youtube.com/watch?v=R2hO--TIjjA

The Solution

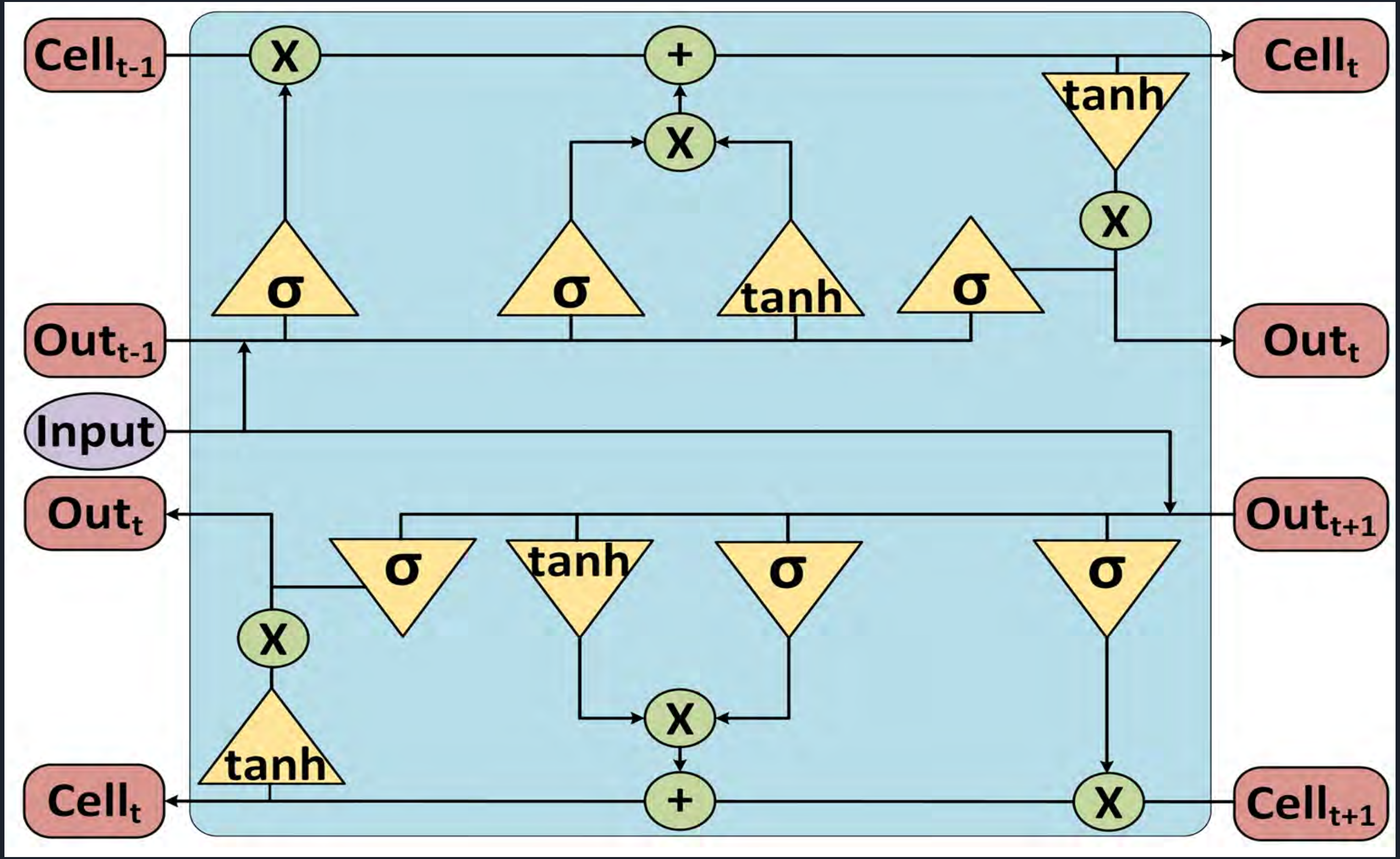
Traditional Methods

- Use hand-designed features
- Require significant domain knowledge
- Generalize poorly to other domains

Deep Learning

- Automatic feature extraction
- Independent of need for prior knowledge
- Higher generalization ability

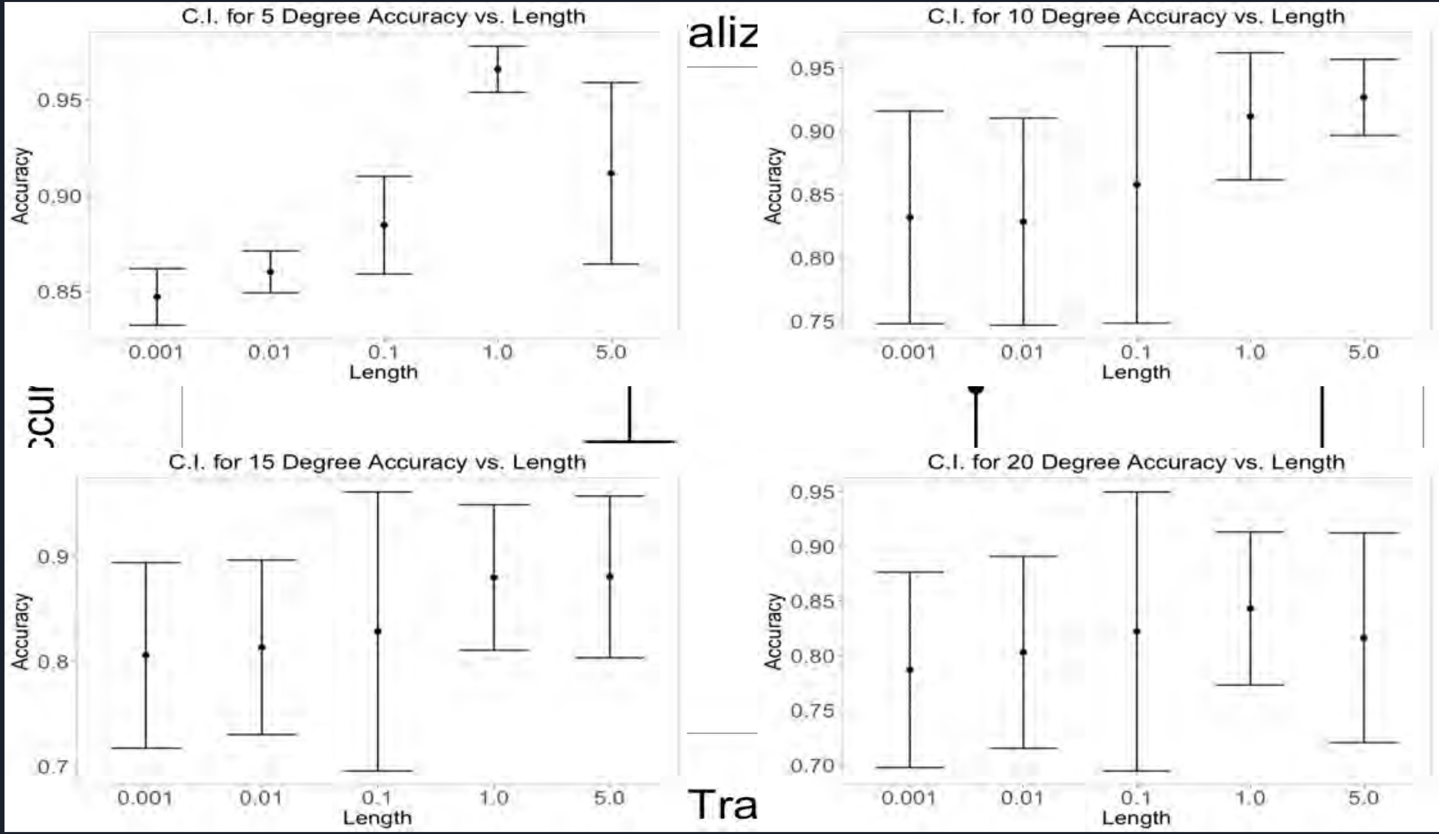
How the Model Works



Experimental Design

- Important to find both the best training sequence length
- Important to find best training fault
- Find the best combination of both

Results

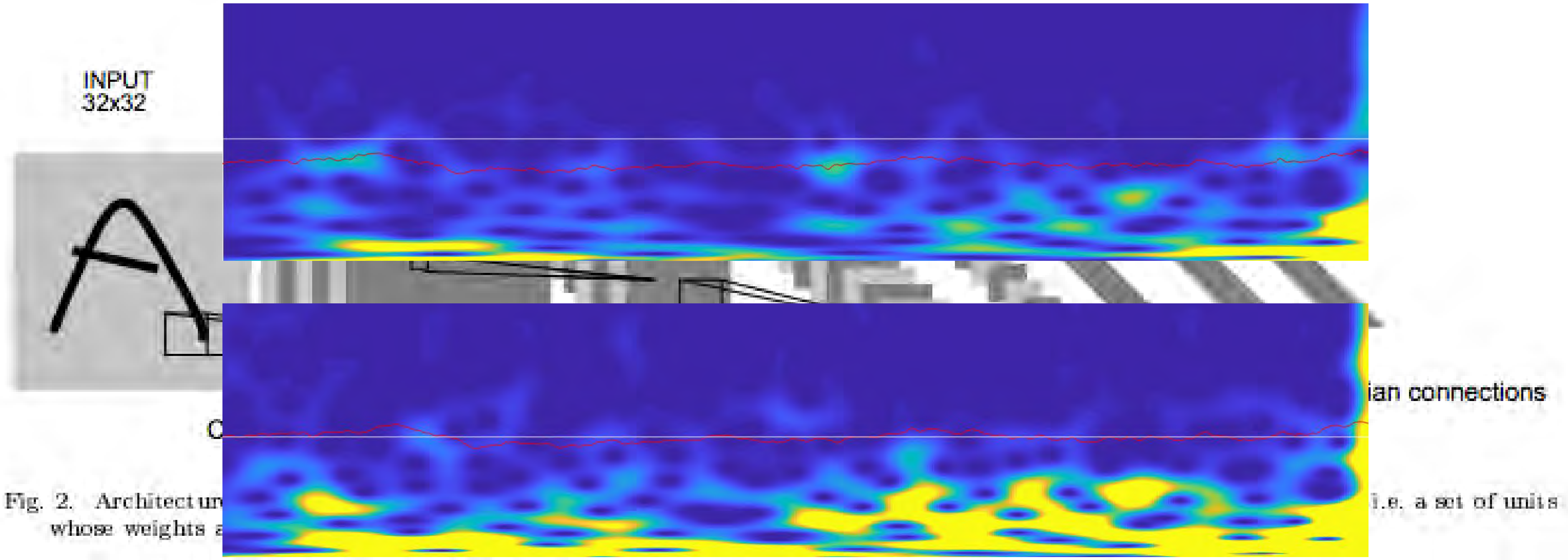


C.I. for 5 Degree Accuracy vs. Length
Accuracy
0.95
0.90
0.85
0.001
0.01
0.1
1.0
5.0
Length
C.I. for 10 Degree Accuracy vs. Length
Accuracy
0.95
0.90
0.85
0.80
0.75
0.001
0.01
0.1
1.0
5.0
Length
C.I. for 15 Degree Accuracy vs. Length
Accuracy
0.9
0.8
0.7
0.001
0.01
0.1
1.0
5.0
Length
C.I. for 20 Degree Accuracy vs. Length
Accuracy
0.95
0.90
0.85
0.80
0.75
0.70
0.001
0.01
0.1
1.0
5.0
Length

Conclusions

- 1 second of data provides the best accuracy
- 5 degrees is the best fault to train on
- Bi-LSTM creates a robust feature space resilient to noise

Applications and Further Research



https://softwarerecs.stackexchange.com/questions/28169/drawing-convolutional-neural-networks