Sensor Raw Data Analysis

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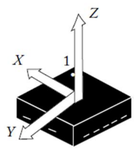
MOTIVATION

- We focus on reducing the offset in the measurement of a Low-G accelerometer MEMS sensor.
- The behavior of the offset changes with temperature and angle of orientation.
- The goal of this project is to devise a method to reduce offset over extreme temperature ranges.
- A Deep neural network (DNN) can predict the offset behavior with a set of test temperatures.
- This DNN predictor will significantly reduce the resources required during the test time.



$X = 0, Y = 0, Z = 1g$

POTENTIAL APPLICATIONS

- Sensors with high precision and sensitivity are an essential part of :
  a. Cyber physical systems
  b. Wireless sensor networks
  c. Health monitoring applications
  d. Military applications

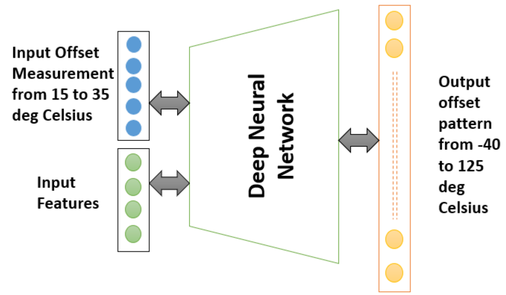
For high precision sensors, we need to reduce the offset.

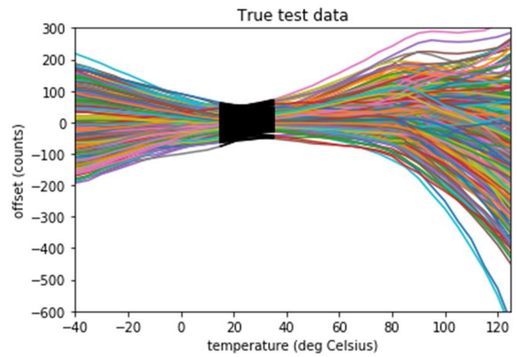
FACTORS RESPONSIBLE FOR OFFSET

Factors that induce offset in the sensor measurements are

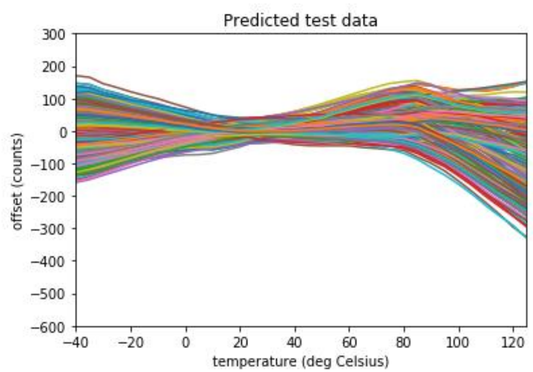
1. Temperature
2. Mechanical stress
3. Socket stress
4. Sensor reuse
5. Angle of orientation

DNN PREDICTOR

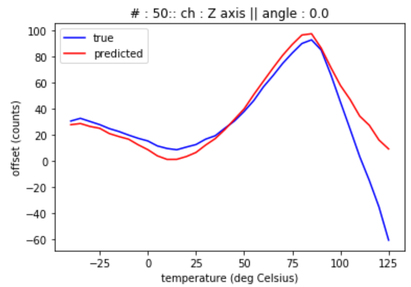


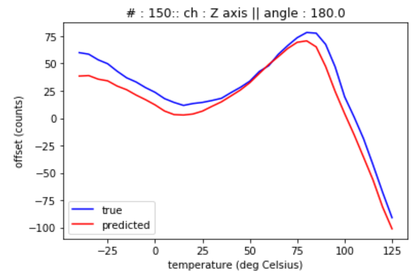


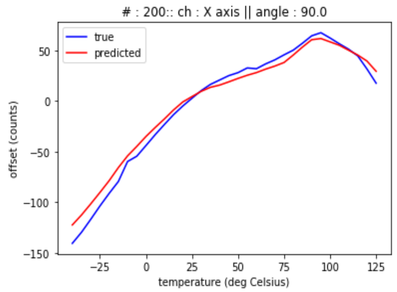
DNN sees only the masked portion of input and extrapolates across temperature

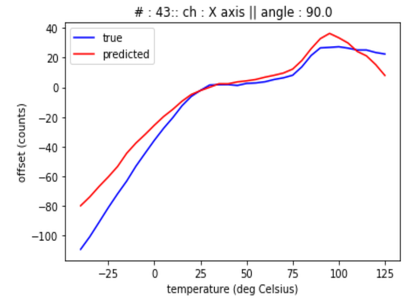


SIMULATION RESULTS









CONCLUSIONS

- A behavioral model for Offset is designed.
- A DNN predictor to predict offset pattern over temperature.
- A model will be devised to include the predictions of DNN and behavioral model to correct offset.
- DNN model significantly reduces resources during test time.

ACKNOWLEDGEMENTS

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REFERENCES

[1] M. Stanley and Jong Ming Lee, “Sensors for IoT Applications”, ISBN 9781627054638, *editor Andreas Spanias, Synthesis Lectures, Morgan and Claypool Publishers,* 113 Pages, March 2018.
[2] J. Lee, M. Stanley, A. Spanias, C. Tepedelenlioglu, "Integrating Machine Learning in Embedded Sensor Systems for Internet-of-Things Applications," *Proc. 2016 IEEE International Symposium on Signal Processing and Information Systems (ISSPIT 2016)*, Dec. 2016.