Machine Learning Application in Accelerometer Temperature Performance

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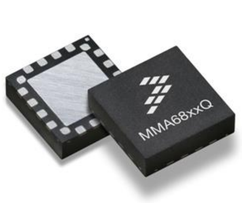
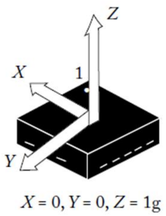
MOTIVATION

- We focus on reducing the offset drift over temperature of a Low-G accelerometer MEMS sensor.
- The behavior of the offset changes with temperature and angle of orientation.
- 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
  e. Auto-motive industry

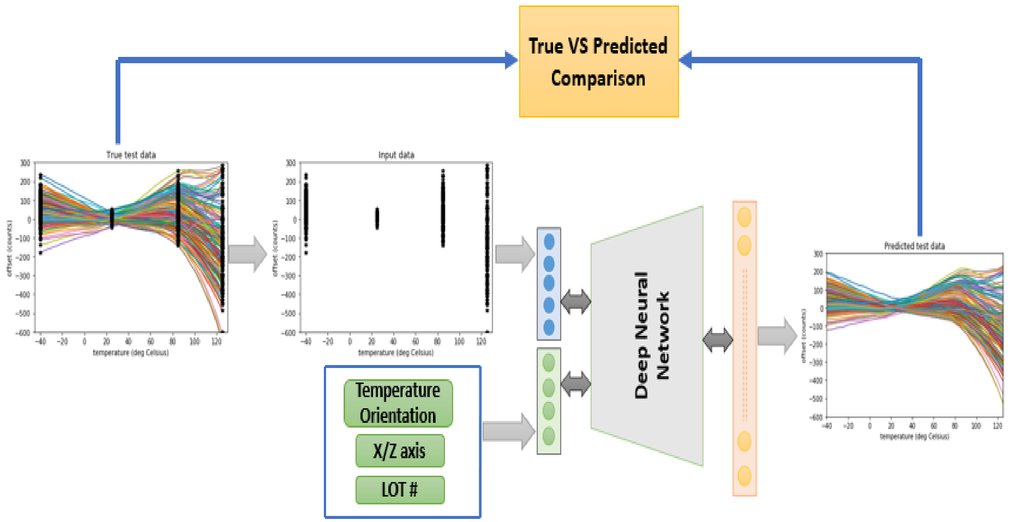
For high precision sensors, we need to reduce the offset.

FACTORS RESPONSIBLE FOR OFFSET

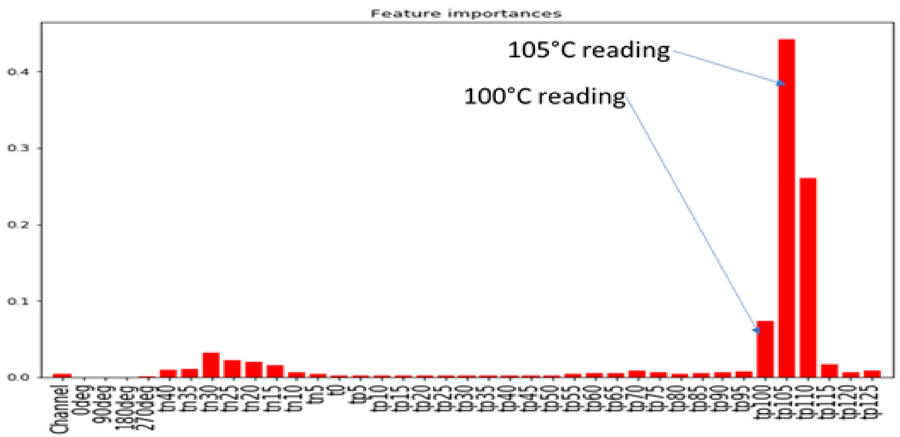
Factors that induce offset in the sensor measurements are

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

DNN PREDICTOR

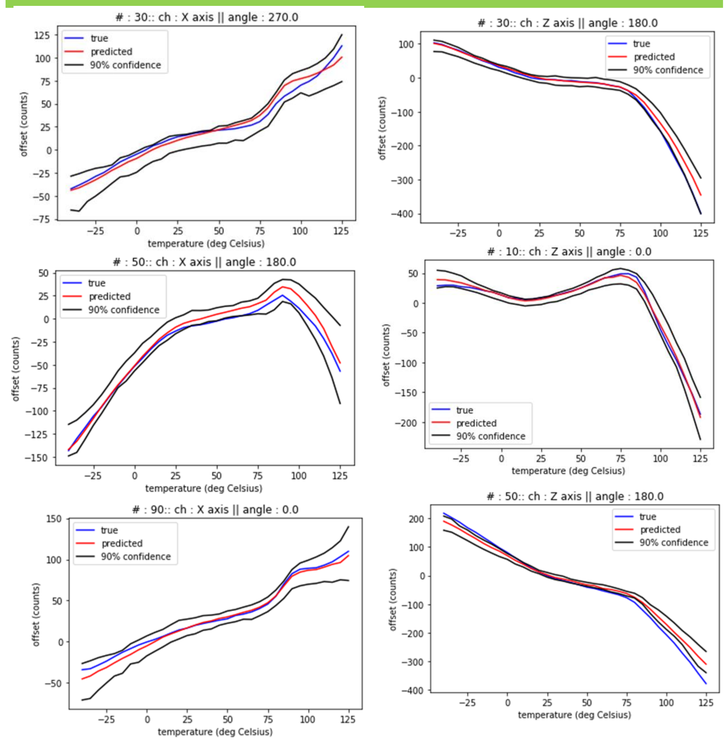


FEATURE IMPORTANCE



The model indicates that the temperature range of 100 to 110 degrees to be of higher importance, which corresponds to the effect of added variation due to the package's glass transition temperature, where we observe an abnormal shift in the offset pattern

SIMULATION RESULTS



CONCLUSIONS

- A behavioral model for Offset is designed.
- A DNN predictor to predict offset pattern over temperature.
- A model to evaluate the importance of each feature.
- DNN model significantly reduces resources during test time.

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.