Learning condition monitoring system

In this thesis project at EISLAB/SRT and Tribolab/TVM you will develop and conduct experiments with machine learning and artificial intelligence algorithms on a ZedBoard prototyping board integrated in a condition monitoring experiment in collaboration with Ph.D. students at the SKF University Technology Centre (UTC). The lab and UTC are located in the E-building. See Figure 1 and the links below for more information. Contact Sergio for a visit to the lab.

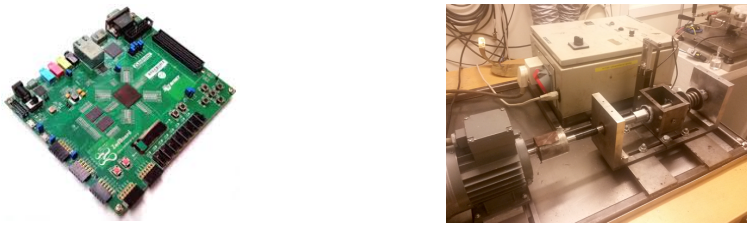

Figure 1. ZedBoard (left) and experiment at Tribolab (right) that will be used in the project.

The ZedBoard is based on a Xilinx Zynq-7000 system-on-chip (SoC) including an FPGA and a dual-core Cortex-A9 processor. Machine learning algorithms for the Zynq chip (unsupervised convolutional neural networks) have been developed in advance using high-level synthesis tools and the C/C++ language. The board is set up with basic functionality and includes two 1 MSPS ADCs that can be used to sample data from sensors. A test-rig at Tribolab, where bearings can be exposed to different operational conditions will be used in the experiments.

The aim of the project is to develop and experiment with a "smart" condition monitoring system that can automatically adapt to the characteristics of a machine in order to detect and prevent abnormal operational states. This includes integrating the ZedBoard with the test-rig and to adapt the machine learning implementation to enable online learning of operational conditions using sensors mounted on the test-rig. Artificial intelligence algorithms for closed-loop reinforcement learning will be investigated in experiments where the ZedBoard should learn to automatically modify the operational condition of the rig in order to fulfill operational goals.

Systems of this type are potentially useful in various applications of SKF bearings. This project address the general problem to automate condition monitoring processes in complex and changing environments, for example in applications like railway involving many similar bearings.

Requirements: Background in Computer Science or Engineering Physics and Electrical Engineering. Knowledge of C is necessary. Knowledge of embedded system programming or digital design, and a general interest in mathematics, scientific computation, machine learning or AI is beneficial. Participation in writing of a scientific paper summarizing the results of the project is encouraged.

Contact: Fredrik.Sandin@ltu.se , Sergio.Martindelcampo@ltu.se
Links: http://www.ltu.se/centres/SKF-LTU-University-Technology-Centre
http://pure.ltu.se/portal/files/96347851/MLSSposter_A1_140410.pdf