Supervised classification with SCADA data for condition monitoring of wind turbines

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ABSTRACT

The reliability requirements of wind turbines have increased significantly in recent years in the search for a lower impact on the cost of energy. In addition, the trend towards larger wind turbines installed in remote locations has significantly increased the cost of repair or replacement of the component. In the wind industry, therefore, condition monitoring is crucial for maximum availability [1]. This contribution makes a review of supervised machine learning classification techniques for wind turbine condition monitoring using only SCADA data already available. That is, without installing extra sensors or costly purpose-built data sensing equipment.

Although there has been extensive research into the use of machine learning techniques for wind turbine monitoring, the more recent trend in this type of literature is to focus on a specific WT sub-assembly: the bearings and planetary gearbox [2], the generator and power converter [3], the blades [4], etc. Oil debris systems can detect pitting failures but cannot detect cracking faults. Vibration based systems can detect both pitting and cracking, but most cannot determine the health of components in the planetary section. This work approaches condition monitoring of various wind turbine components (torque actuator, pitch actuator, pitch sensor, and generator speed sensor) with a unique strategy. In particular, for this purpose, a review of supervised machine learning classification techniques is performed and analyzed.

REFERENCES

[1] Y. Vidal, F. Pozo and C. Tutivén, "Wind Turbine Multi-Fault Detection and Classification Based on SCADA Data", *Energies*, Vol. **11**, 3018, (2018).

[2] S.T. Kandukuri, A. Klausen, H.R. Karimi, H.R. K. G. Robbersmyr, "A review of diagnostics and prognostics of low-speed machinery towards wind turbine farm-level health management" *Renew. Sustain. Energy Rev.*, Vol. **53**, 697–708, (2016).

[3] S. Huang, X. Wu, X. Liu, J. Gao, Y. He, "Overview of condition monitoring and operation control of electric power conversion systems in direct-drive wind turbines under faults". *Front. Mech. Eng.*, Vol. **12**, 281–302, (2017).

[4] F.X. Ochieng, C.M. Hancock, G.W. Roberts, J. Le Kernec, "A review of ground-based radar as a noncontact sensor for structural health monitoring of in-field wind turbines blades" *Wind Energy*, Vol. **21**, 12, (2018).