

Ignition Pattern Analysis for Automotive Engine Trouble Diagnosis using Wavelet Packet Transform and Support Vector Machines

VONG Chi-man^{1*}, WONG Pak-kin², TAM Lap-mou², ZHANG Zaiyong²

*1 Department of Computer and Information Science, Faculty of Science and Technology,
University of Macau, Macau, China*

*2 Department of Electromechanical Engineering, Faculty of Science and Technology,
University of Macau, Macau, China*

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Abstract: Engine spark ignition is an important source for diagnosis of engine faults. Based on the waveform of the ignition pattern, a mechanic can guess what may be the potential malfunctioning parts of an engine with his/her experience and handbooks. However, this manual diagnostic method is imprecise because many spark ignition patterns are very similar. Therefore, a diagnosis needs many trials to identify the malfunctioning parts. Meanwhile the mechanic needs to disassemble and assemble the engine parts for verification. To tackle this problem, an intelligent diagnosis system was established based on ignition patterns. First, the captured patterns were normalized and compressed. Then Wavelet Packet Transform (WPT) was employed to extract the representative features of the ignition patterns. Finally, a classification system was constructed by using multi-class Support Vector Machines (SVM) and the extracted features. The classification system can intelligently classify the most likely engine fault so as to reduce the number of diagnosis trials. Experimental results show that SVM produces higher diagnosis accuracy than the traditional multilayer feedforward neural network. This is the first trial on the combination of WPT and SVM to analyze ignition patterns and diagnose automotive engines.

Key words: automotive engine, ignition pattern diagnosis, pattern classification, wavelet packet transform, support vector machines.

* Corresponding author: E-mail: cmvong@umac.mo

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