Abstract

Internal combustion engines frequently develop faults. Experienced mechanics and technicians can often identify an engine fault by the sound it makes. These skills require significant training to master. If it is possible for humans to identify these sounds, it too could be possible for an automated system to diagnose faults. This dissertation presents a system that uses smartphone audio as a non-invasive method to identify engine faults by sound. A system to detect engine RPM, engine misfires and low cylinder compression is proposed by using methods from Digital Signal Processing and Music Information Retrieval. Time-frequency domain features are considered to identify features produced by engine events. Fault states are inferred from abnormal occurrence of these features. Statistical analysis is also used to determine engine cycle similarity when turning the engine over. A metric is then devised from this data to infer low cylinder compression. Experiments are devised to evaluate the system. Experiments use both iOS and Android smartphones, inside and outside the vehicle. It is found that the approach is effective at identifying misfires and low engine compression across many smartphone types and recording positions. The results indicate that the approach performed well even in sub-optimal recording conditions. The results of this dissertation will be used to develop further work in the area of internal combustion engine fault detection.