Supplementary File

Data Collection

Testing was completed in the MTU South Campus Engineering Lab using Lathe machines. These were the Colchester Triumph 2000 Lathe Machines shown in Figure S1. These machines have been in operation for multiple decades, were installed at different points in time, and operate differently. These machines are primarily used to shape metal. The metal in question is rotated around a cutting tool which is maintained in a stationary position. Testing was to be performed in five or six stages, these being multiple minutes of recording. Within each stage of recording, a different cutting tool would be utilized. As the tests progressed, a higher level of degradation of the cutting tool would be employed, with the first test using a fresh cutting tool and the last using a very worn and damaged one. Some samples are shown in Figure S2. This experiment aimed to show that machinery using older or damaged equipment instead of newer ones can experience poorer performance, which can be shown in the acoustic analysis. The acoustic signals with a microphone (sampling frequency is 10 kHz) have been saved near to the cutting tool shown in Figure S3. Each of these cutting tests had to be limited to only several minutes due to the limitations of the lathe machines themselves. In order to eliminate motor noise in the cutting sound, we have applied an adaptive filter shown in Figure S4. All processes are repeated five times with different lathe machines to obtain different datasets to check the proposed algorithm performance on different machines using the transfer learning technique.
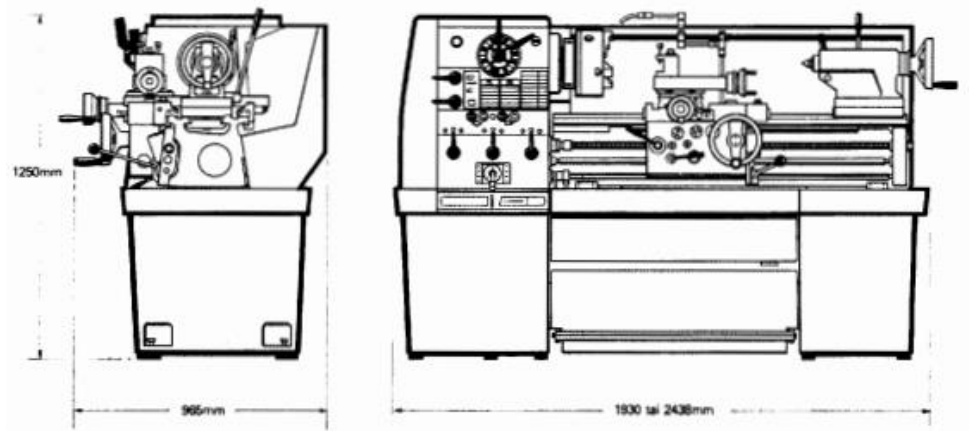

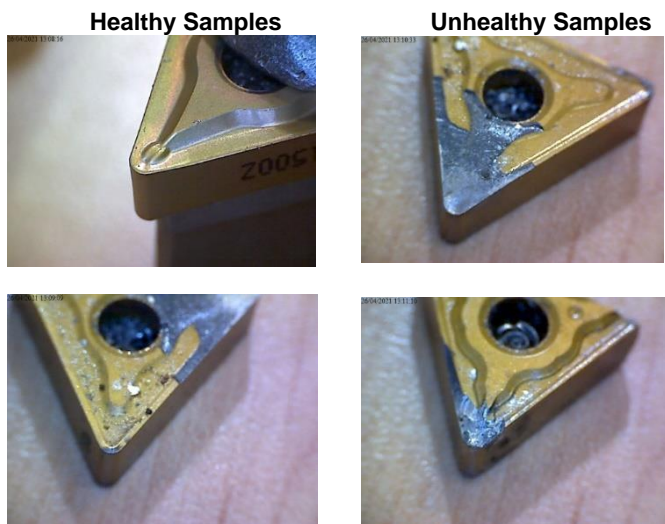**Figure S1 Colchester Triumph 2000 Lathe Machine Dimensions**

Healthy Samples   **Unhealthy Samples**
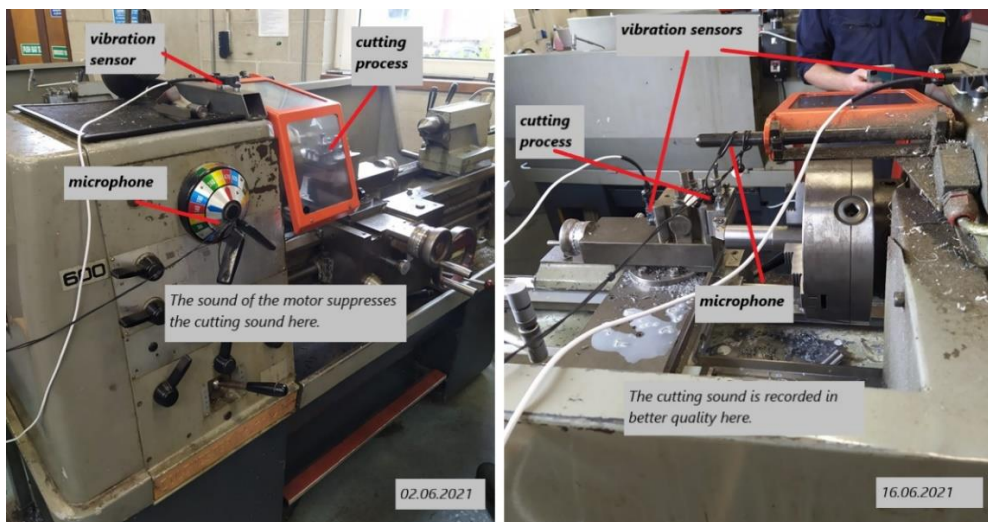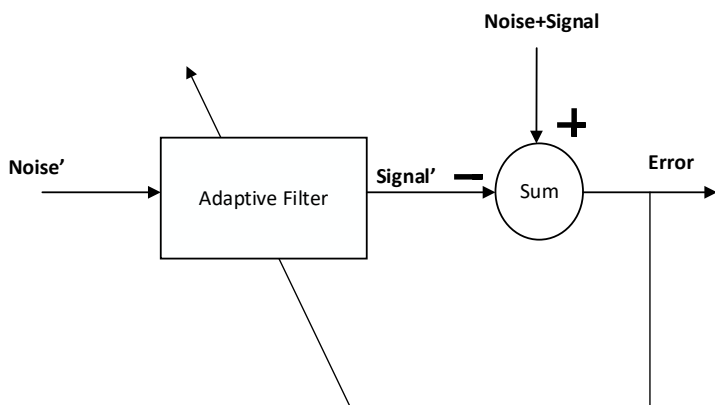
Figure S2 Some Samples from the Experiment

Figure S3 Data Collection

Figure S4 Denoising Process