

Cutting Tool Condition Monitoring with Artificial Intelligence

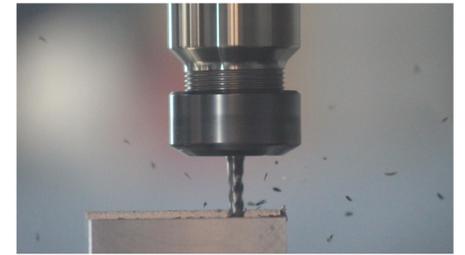
Lorenzo COLANTONIO

Context

- Machining operations are widely used to produce everyday products – Turning or Milling
- The cutting tool used deteriorates, resulting in poor quality surfaces
- Replacing the cutting tool at the optimal moment
 - Too early → Waste of the tool and replacement cost
 - Too late → Waste of the machined surface and associated costs

→ Need to track and predict the degradation of each tool for optimal replacement

Turning operation

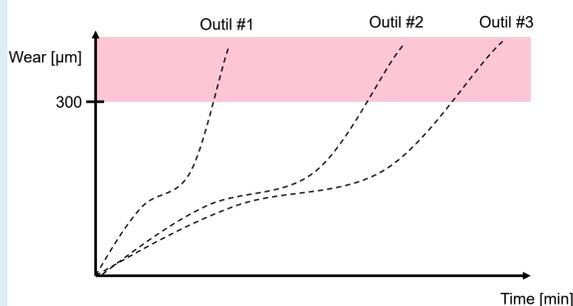


Degradation of the Tool & Technical Limitations

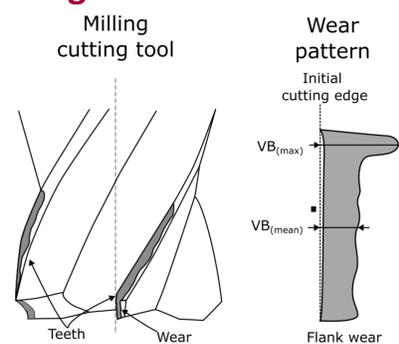
- Multiple degradation mechanisms occurring simultaneously → Impossible to predict beforehand
- A worn tool cannot produce a good surface quality
- Due to production constraints → not possible to stop the operation to check the state of the tool
- Indicator of wear : **VB** → wear land width on the flank face (worn if > 0.3 mm – ISO 8688)

→ Need to predict the state of the tool from indirect cutting signals

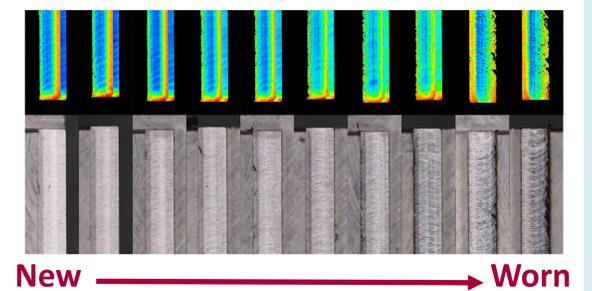
Unpredictable degradation path



Degradation of the tool

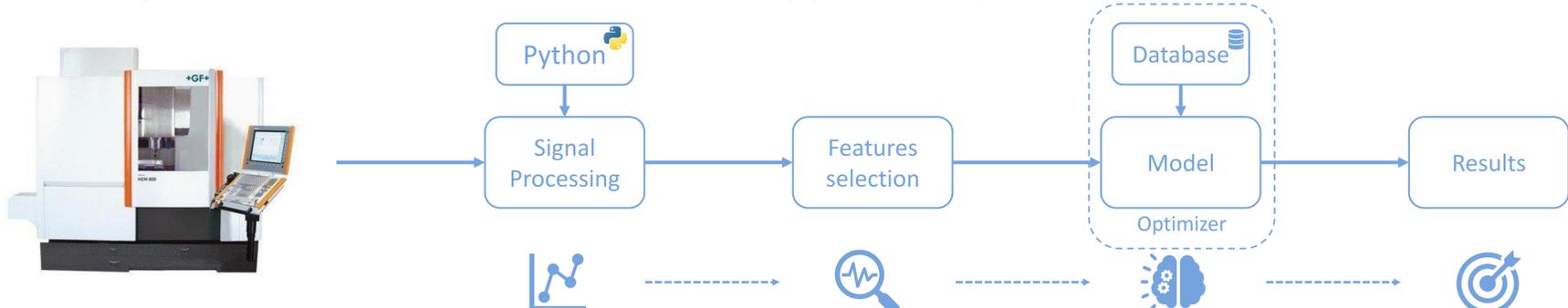


Degradation of the workpiece



Our Approach

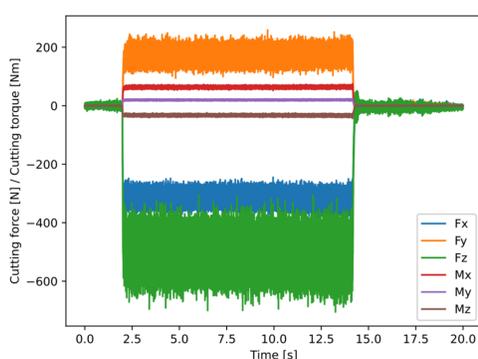
- Use the signal from **instrumented machine tool** to feed a « pipeline » of operations



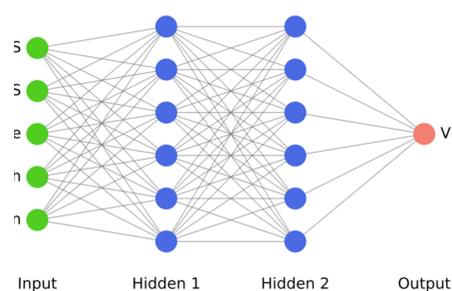
Results

- From the signal generated by the sensors, we can follow the evolution of the degradation accurately and in real time

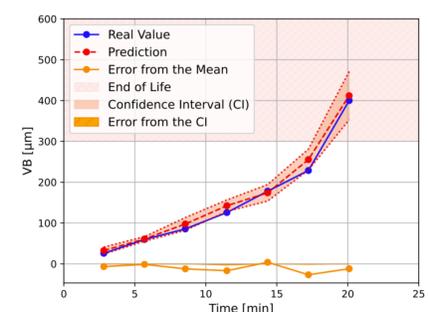
Processed Signal



Neural Network



Predicted Degradation



Conclusions & Perspective

- The proposed approach demonstrates the ability to monitor tool degradation with real time indirect monitoring
- High industrial interest
- Further work will focus on improving the robustness of the approach for industrial applications