Feasibility study of using a camera to assess the performance of a knife

One of the main factors of interest was the potential to assess sharpness by looking at the radius of curvature of the cutting edge.

There is no agreed upon definition for sharpness - Reilly, G. A., B. A. O. McCormack, and D. Taylor. “Cutting sharpness measurement: a critical review.” *Journal of Materials Processing Technology* 153 (2004): 261-267.

By measuring sharpness through observation

By looking at electron microscope images of a sharp knife it was found that the diameter of curvature of an extremely sharp blade is approximately 0.3μm this lies within the range of wavelengths of visible light it would not be possible to use a light microscope to capture images.

Fourier ptychographic microscopy was explored as a method to increase resolution of capture images. This uses an angularly varying LED illumination and phase-retrieval algorithm to surpass the diffraction limit.

Concepts for angularly varying LED illumination

* LED array
* LED array from below + mirror
* Single Ring of LEDs (around lens)
* Multiple rings of LEDs (around lens)
* Single LED rotated using a motor

A number of supply shortages has produced delays impacting the design.

Looking into auto focusing methods - <https://www.youtube.com/watch?v=B-TOUPXytw4>

Contrast detection

* Active – using light or sonar to calculate distance from camera
* Passive
  + Phase detection -measure difference between two paths of light and align
  + Contrast detection – only uses imaging sensor

Open CV

Tensor flow