# USING FREQUENCY INFORMATION AND YOLOV5 OBJECT DETECTOR FOR WHEAT HEAD DETECTION

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INTRODUCTION

Object detection is a technique in computer vision that allows for identification of objects in an images. This report analyses the performance of YOLOv5 object detector run on frequency filtered images and compares it to running it on the original images.
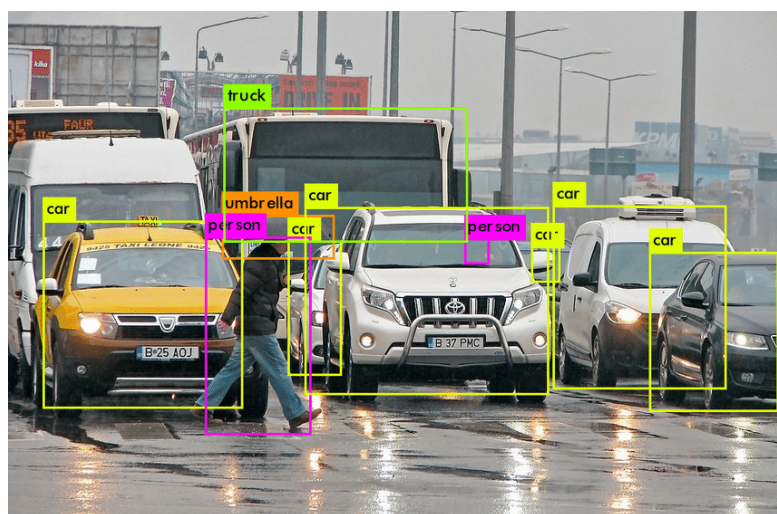
Various object detectors exist today. YOLOv5 object detector is used in this experiment. Fourier Transform (FT) is used to map to frequency domain and perform filtering.
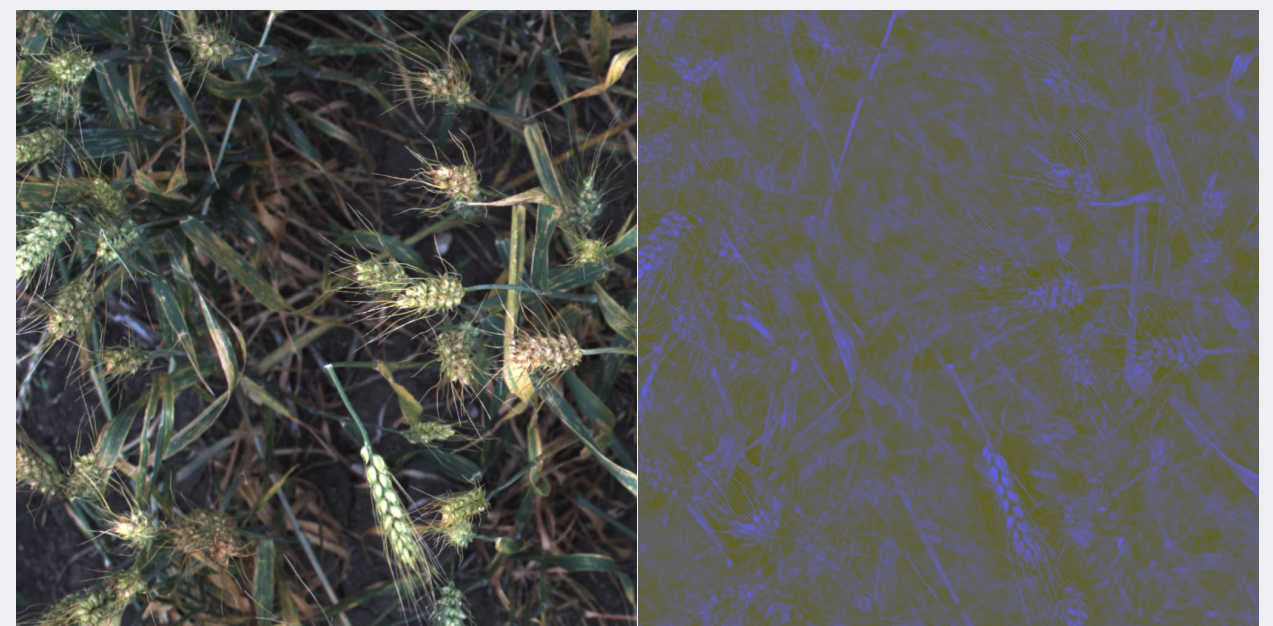
What is frequency?
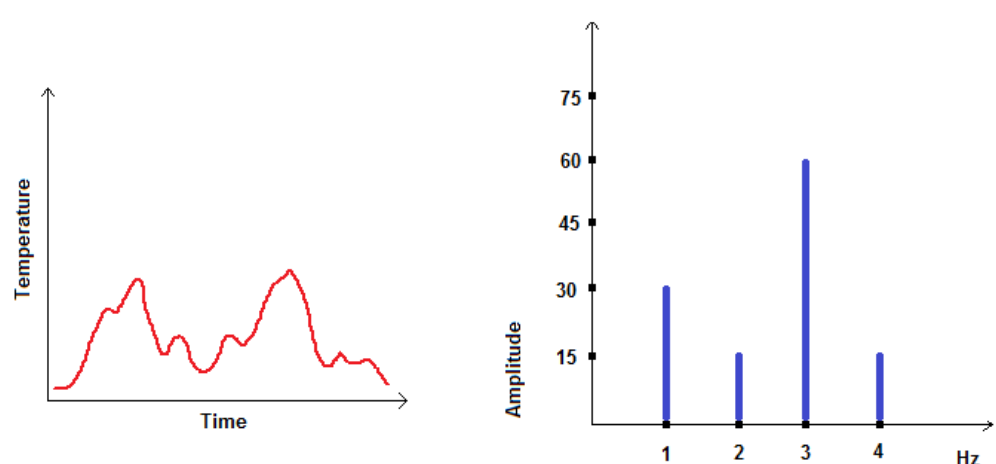
Sounds and images are usually represented in time or space domain, but there is the notion of frequency. Fourier transform maps between frequency domain and space/time domain:

$$F(k,l) = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} f(i,j)\, e^{-\iota 2\pi(\frac{ki}{N} + \frac{lj}{N})}$$

The challenge

Given the Global Wheat Head Dataset, verify what impact "silencing" specific frequencies has on an object detector.
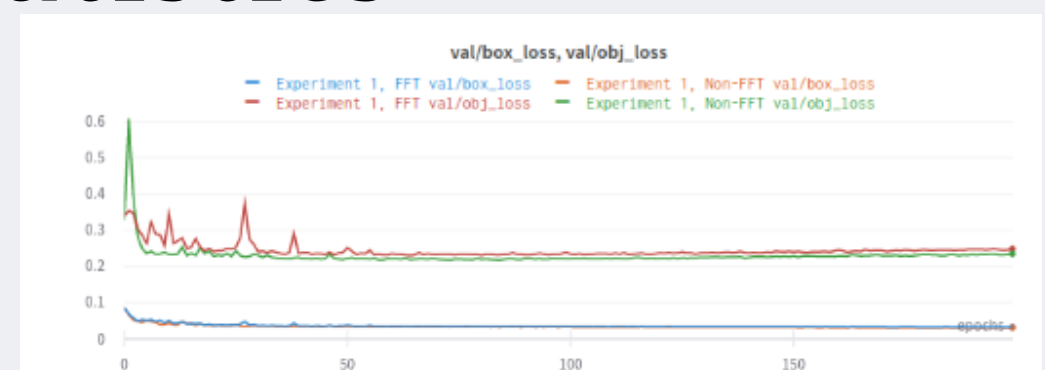

(Yolov5, 80 images, img size 1024, 40 epochs, cached images)

Methodology

Apply FFT on the images, create a frequency mask filtering out specific frequencies also using a band-pass filter, map to spatial domain, run YOLO and compare results.

Statistics

metrics	images	labels	precision	recall	$mAP\_0.5$	$mAP\_0.5 : .95$
$non-FFT$	507	22200	0.947	0.929	0.955	0.578
FFT	507	22200	0.943	0.91	0.939	0.559

Conclusion

Using this specific frequency filter does not improve accuracy of YOLOv5 object detector.