Project Title: Automatic placement of low-resolution missing fruit in same higher resolution scene

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- **Summary**: Given two images (src, dst), where dst is of the same scene as src, but **different perspective** and higher resolution. Additionally, dst is also missing a single fruit from the original src. Our goal is to **classify**, **upsample** and insert the missing fruit into dst with the proper resolution (and possibly different size) and orientation (**homography**)
- **Inputs**:
  - Low resolution image with multiple fruits
  - User defined bounding polygon around fruit to be inserted
  - High resolution image with one missing fruit
- **Output**:
  - Missing fruit classified
  - Higher resolution image with missing fruit inserted at correct position with a certain upsampling scale
- **Methods**:
  - **Classify**: Train a **CNN** on fruits
  - **Upsample**: Upsample using a **Generative Adversarial Network** that produces "Super Resolution" Images called **SRGAN**[1]
  - **Homography:** As described in lecture and following practical tutorials [2] [3]
- **Issues**:
  - Training time may be long for SRGAN depending on dataset chosen, same also applies for CNN
  - The classifier will not be able to detect uncommon fruits if dataset is missing that form of fruit
  - We still have not covered GANs in lectures, which may mean we may not be able to implement one from scratch and/or debug properly
  - Generated object in higher resolution image may look off due to improper orientation
- **Steps**:
  - Download the fruit 360 dataset[4] and train the classifier
  - Download the SRGAN dataset or a trained SRGAN (depending on time constraints) [5]
  - Download the pretrained VGG19[6] model that is used in the SRGAN discriminator if we were to implement our own
  - Crop missing fruit by using user defined polygon, and upsample using SRGAN
  - Perform homography estimation to match the intersecting objects to destination image
  - Place the upsampled image in the destination image using the homography matrix and show the final high-resolution image (Where the missing item was originally located in the 'src' image)

- **Note**: We are planning on implementing all the models/algorithms from scratch, but in case things don't work out, there are widespread implementations each of which we can pull from existing sources (Cited below)

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[1] https://arxiv.org/pdf/1609.04802.pdf

[2] https://www.learnopencv.com/homography-examples-using-opencv-python-c/

[3] https://docs.opencv.org/2.4/modules/imgproc/doc/geometric_transformations.html?#getperspectivetransform

[4] https://github.com/Horea94/Fruit-Images-Dataset

[5] https://github.com/tensorlayer/srgan

[6] https://mega.nz/#!xZ8glS6J!MAnE91ND_WyfZ_8mvkuSa2YcA7q-1ehfSm-Q1fxOvvs