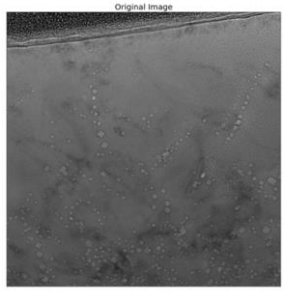
Deep Learning for Microscopy Image Analysis in Materials Science: Advancing Research and Education Workshop

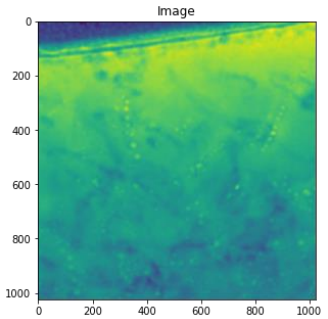
Data Augmentation Techniques

Dr. Shradha Agarwal, Tommy Wong

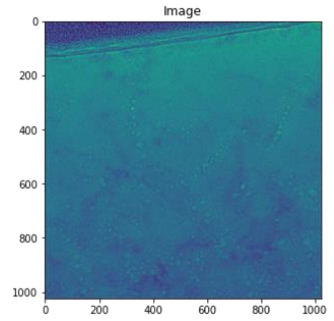
Original



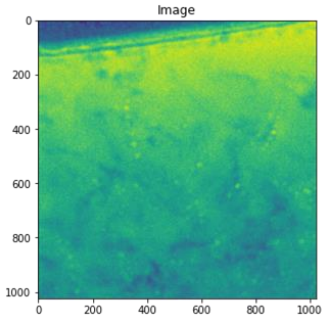
Blur



Salt & Pepper



Gaussian



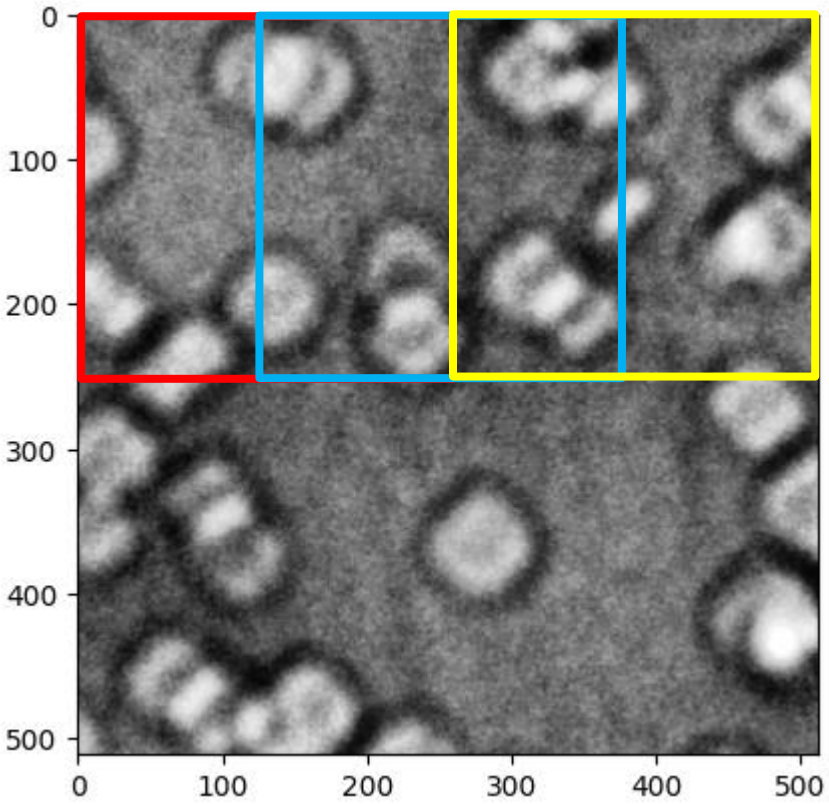
Data from Wang et al. (2019) https://doi-org.utk.idm.oclc.org/10.1016/j.mtla.2018.100183

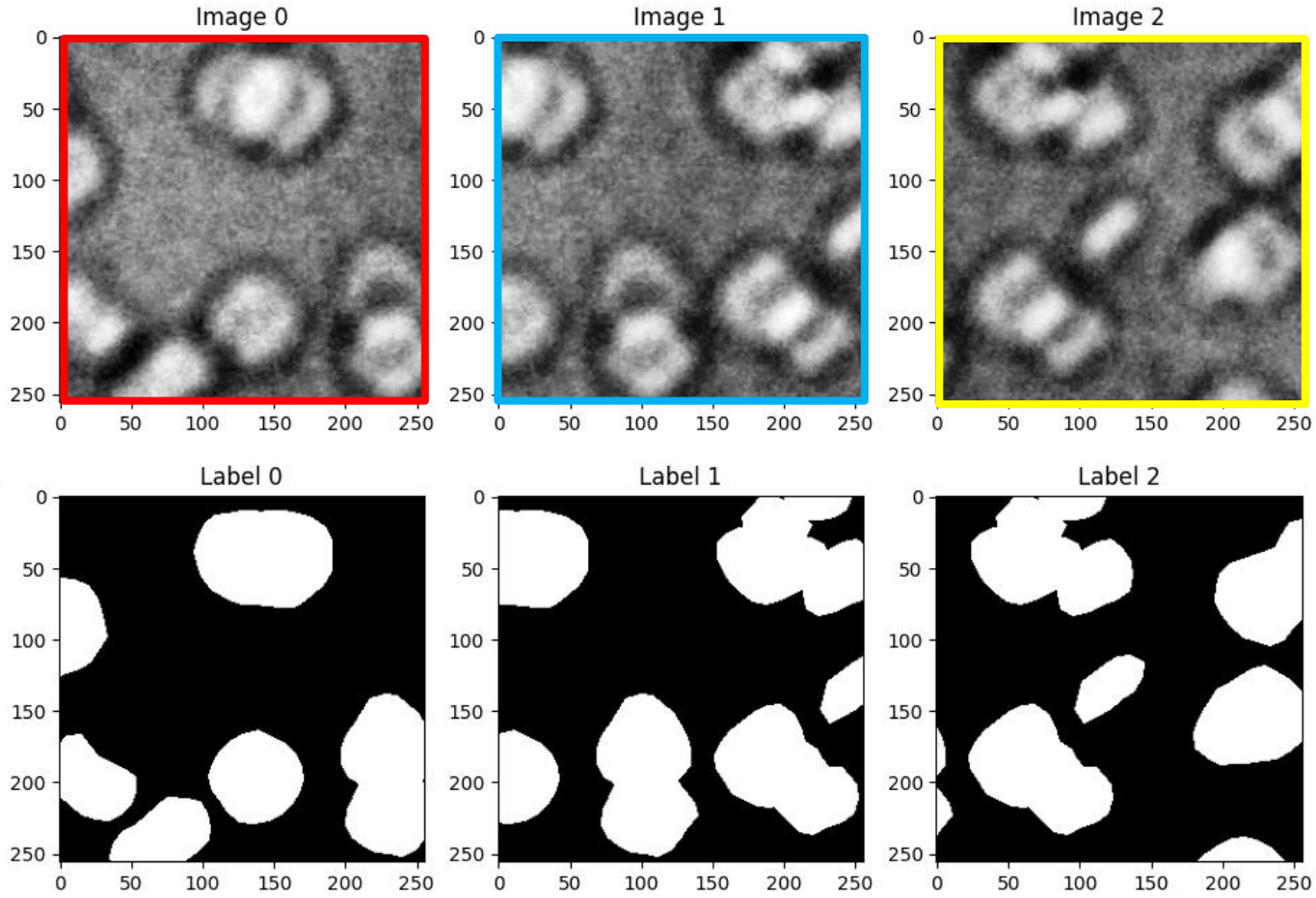
Rationale: more varied data → less overfitting

Electron microscopy experiments yield (relatively) small datasets

∴ requires augmentation

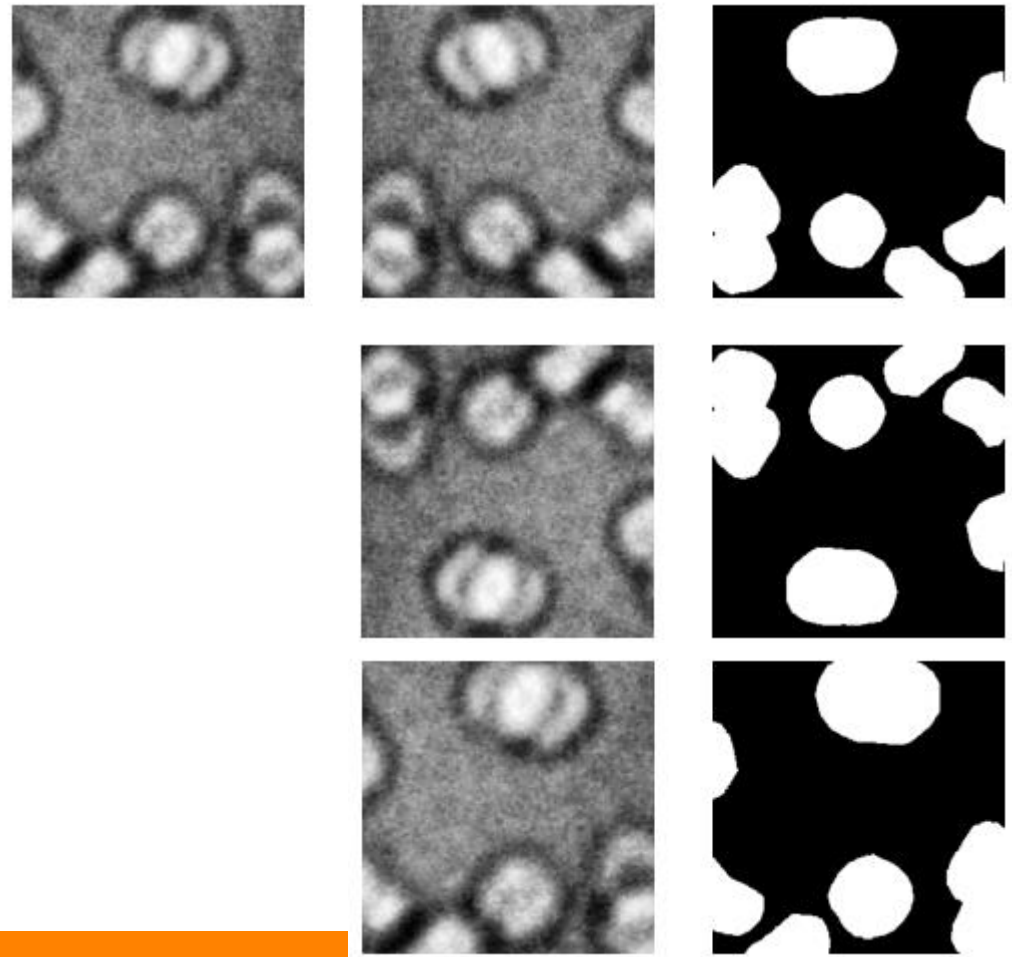
Use a sliding window cropper to enhance the dataset





Rotate, flip, resize the image to increase variability

Original



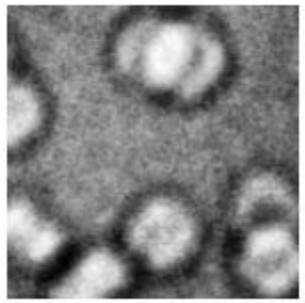
Flipped/Mirrored

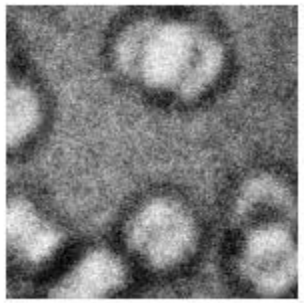
Rotated 180 degrees

Zoomed in

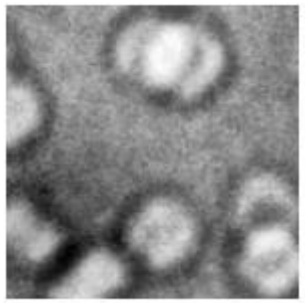
Adding noise to simulate noises during imaging

Original

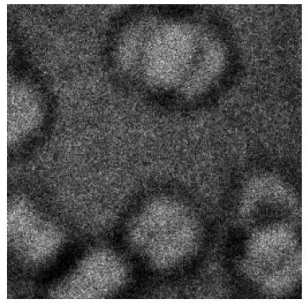




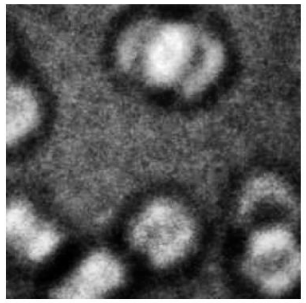
Gaussian



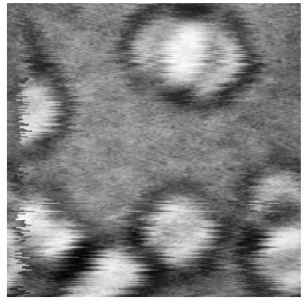
Background noise



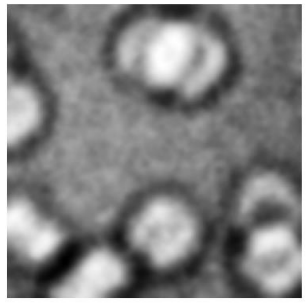
Poisson



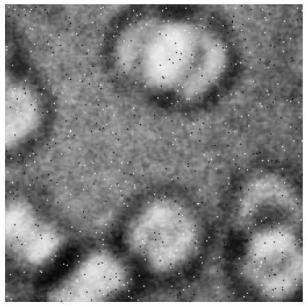
Contrast



Jitter



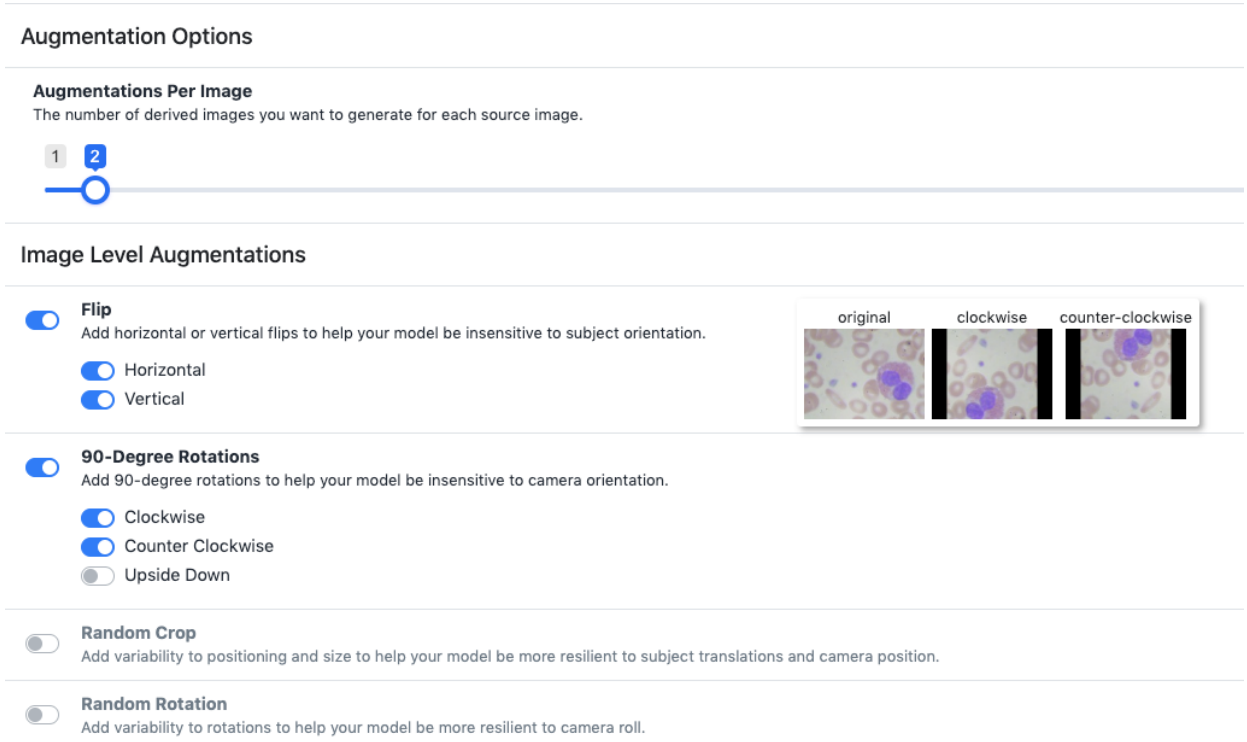
Blur



Salt & pepper

Different ways of implementing augmentation

Roboflow.com web GUI



AtomAI Python functions

github.com/pycroscopy/atomai

```
images, labels = img_augmentor(nb_classes=1, images=train_images, labels=train_labesl, seed=0,
                               zoom=zoom, rotation=True, gauss_noise=gauss_noise,
                               poisson_noise=poisson_noise, blur=blur, contrast=contrast,
                               salt_and_pepper=salt_and_pepper, jitter=jitter, background=True)
```

AtomAI

Deep Learning for Microscopy

Augmentation demonstration

https://github.com/shradhautk/AI-MICROSCOPY-WORKSHOP/blob/main/Day2_Education_Day/Data_Augmentation/DL_for_Microscopy_Data_Augmentation.ipynb