

Project Ideas - Declutter/Discovering Science

There are two ideas of interest here

- Use machine learning to 'declutter' detector images, that is separate the background signal from the signal of interest. For instance, if we can classify different kinds of lasing vs nonlasing images, can we then use a technique like guided back propagation to identify the regions in the image that correspond to the lasing ('declutter' the original image)
- Use Machine learning to 'discover science' - take datasets where we don't need a classifier, i.e, diffraction patterns of virus A and diffraction patterns of virus B - train a classifier to distinguish them, and then use guided back propagation to see what the algorithm thinks are the differences. The thought is that it is difficult for us to distinguish the real 'scientific' differences between virus A and virus B, but that the ML uncovers some hidden structure.

Recent Ideas (from Mihir)

There is this very popular idea these days called Generative Adversarial Networks. An essential component of this is to training something called a discriminative network. One which discriminated between a real image and a fake image. In our case it could be something like an image of virus A vs an image of Virus B. Doing Guided backpropagation on this could be really interesting. ref: <http://arxiv.org/pdf/1406.2661v1.pdf>

Another interesting approach could be finding a pretrained Neural Network that is already giving really good error on the ImageNet dataset. These networks produce really nice guided backpropagation features. It would be interesting to train more layers on top of it or eliminate the top half of the network and train some more layers on the bottom half for our virus problem . Then maybe doing guided backpropagation could really help us.