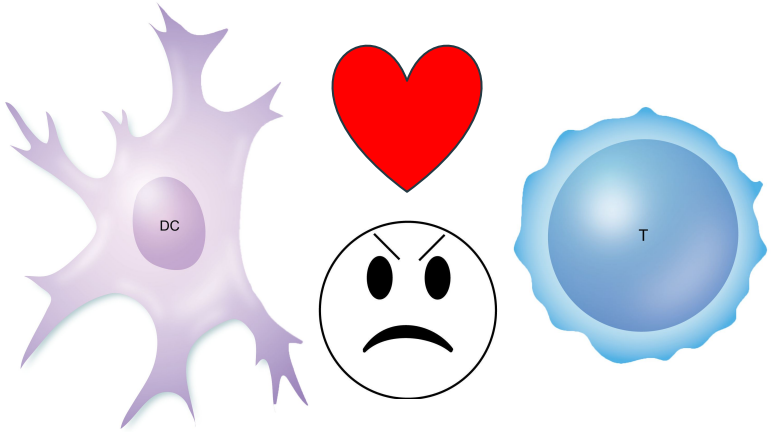
Deep learning for analysing immune cell interactions

Level 4 Honours Project – Leonore Papaloizos

Motivation

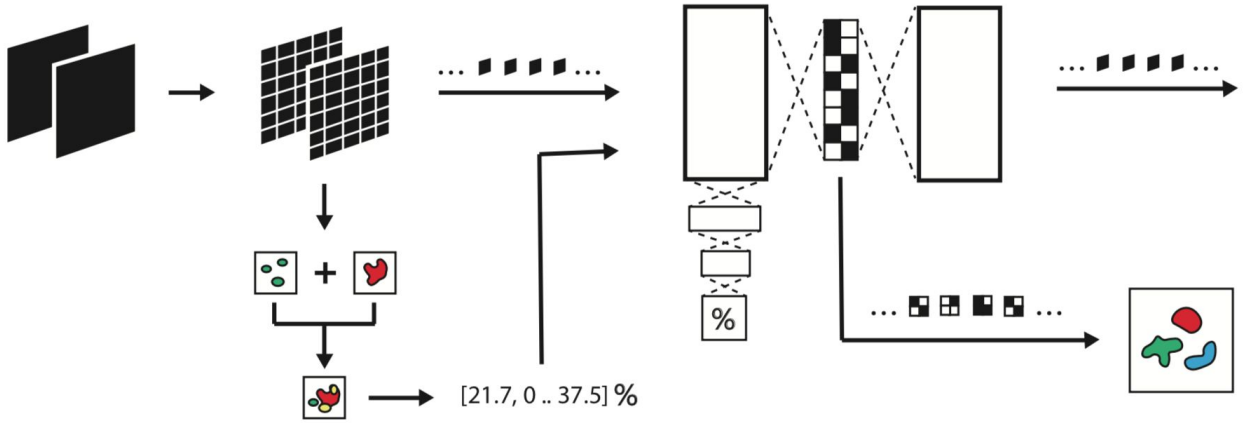
Let’s talk about our immune system!



How can the interaction between immune cells be analysed with deep learning?

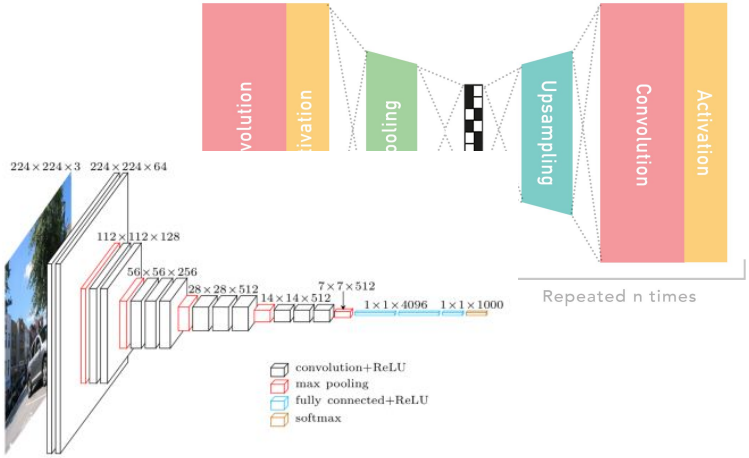
- Previous research has shown neural networks are efficient in processing images
  - Recent advances have successfully applied deep learning to cancer research
- We have a large amount of data available
  - High-dimensional
- We want to explore the use of autoencoders for analysing these images
  - Unsupervised learning → visualisation of the data in 2D plane
  - Building block for supervised learning → regression
- Questions we are looking to answer:
  - Is there an underlying structure in images of immune cells under different immune conditions?
  - Can we quantify interaction from an image of immune cells?

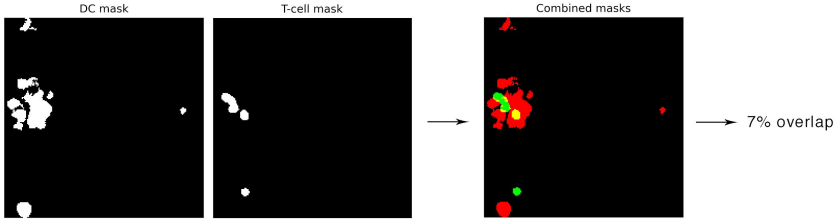
What did we build?



Implementation specifics

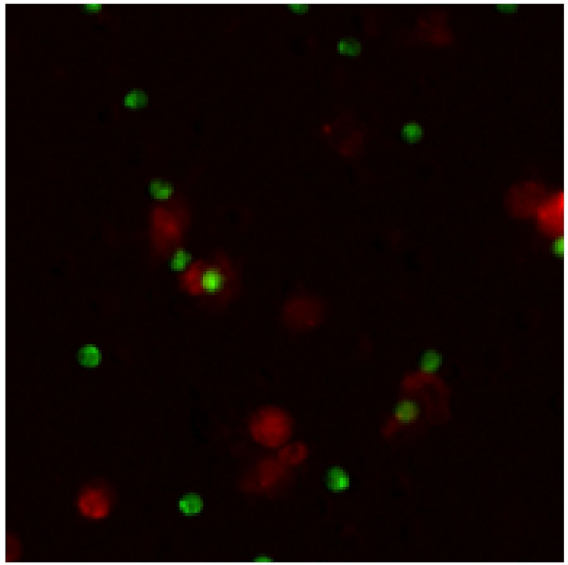
- What was the autoencoder like?
- What was the regression model like?
- How were images segmented?



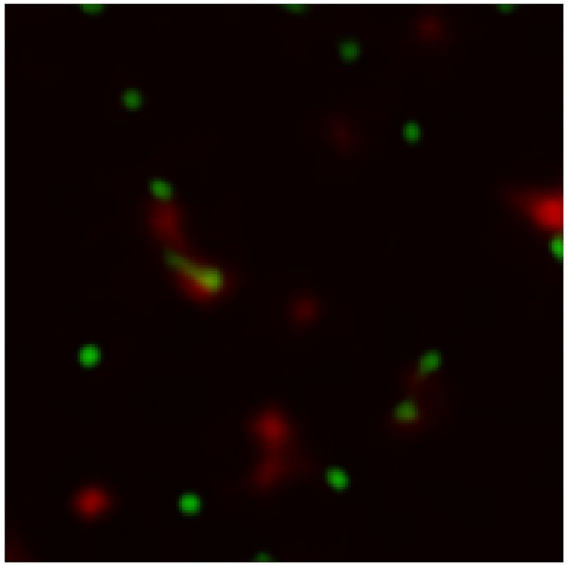


How well can we reconstruct images with an autoencoder?

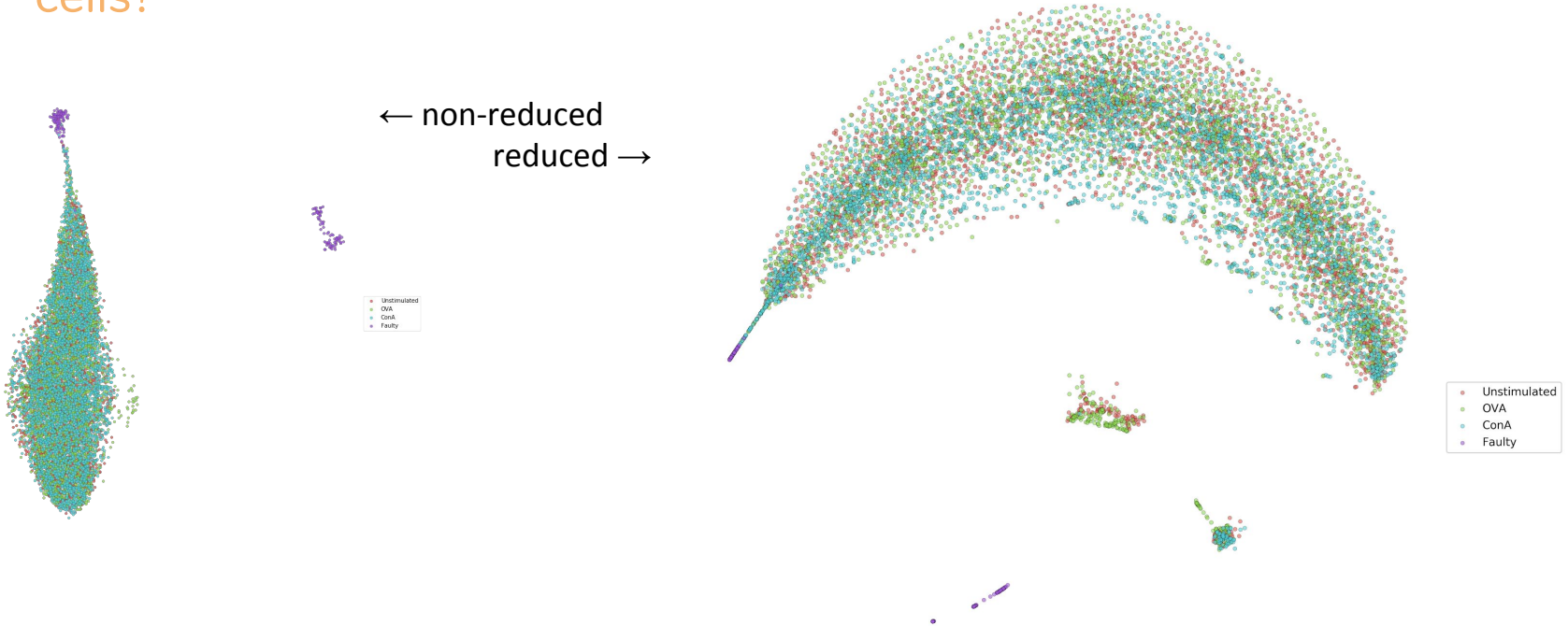
original image [index 9721]



reconstructed image



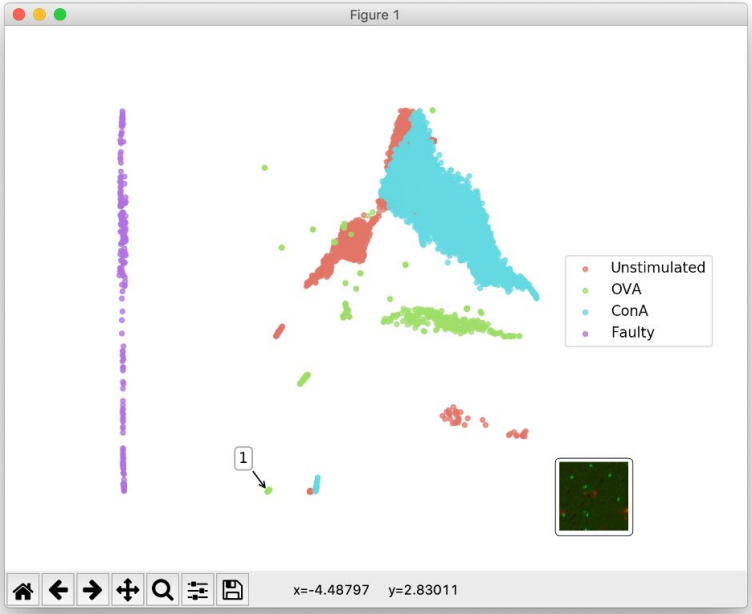
Can we find an underlying structure in the images of immune cells?



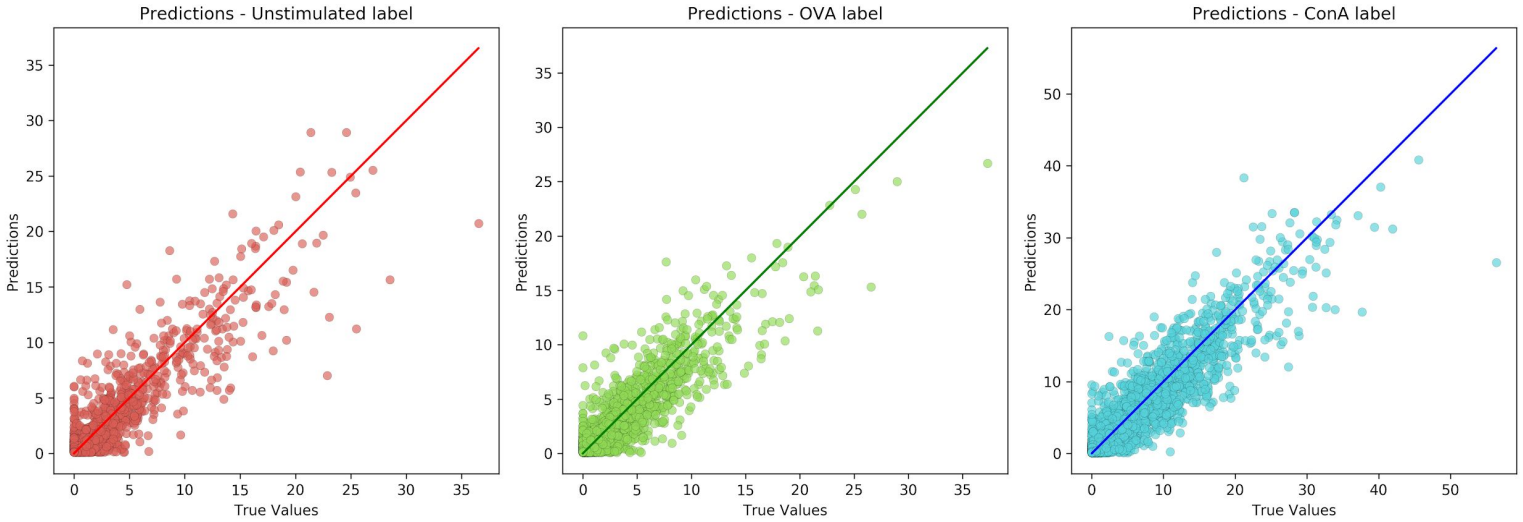
How is the projection generated?

*To be generated for our dataset

Outlier exploration



Can we quantify interaction in unseen images of immune cells?



RMSE score: 1.8380694389343262

Summary