

Week 3

Progress during 13-19th July

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Contents

- 1 Unsupervised learning in star-galaxy classification/segmentation
- 2 Generative models for Ising model; scale expansion for MCMC



About this project

- It's Edward's idea to use unsupervised learning to perform star galaxy classification and segmentation.[Github]
- Method used: surrogate class + CNNs + hypercolumn
- Problem: too many surrogate classes



Plan for this project

- Use VAE instead of surrogate class + CNNs before Hypercolumn
 - ① Too many classes: if we have 50,000 objects in the frame pic, we should have 50,000 different surrogate classes and then 50,000 units in the output layer.
 - ② Overfit: if we use CNNs and surrogate classes to implement a classification task, overfitting is inevitable.
- Sophie and I will work together on this project
- I had a demo before we got access to the SDSS data this week, on the Galaxy Zoo dataset.



A demo of the VAE part

- Uploaded to our jupyter notebook on github.[Jupyter:Hao_galaxyzoo.ipynb]

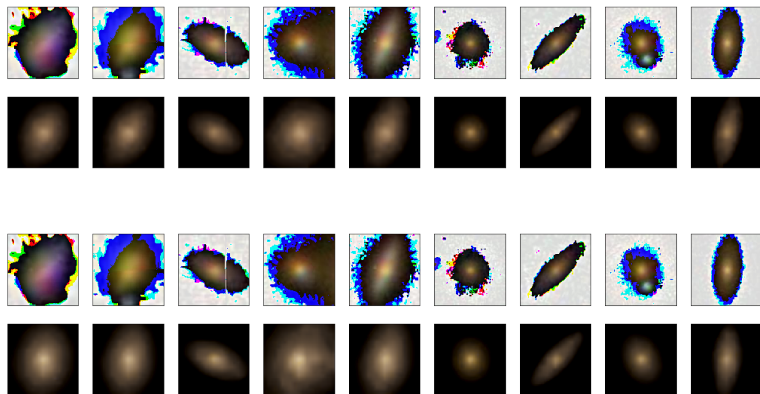


Figure: With 3 hidden units(upper) and 2 hidden units(lower)



A demo of the VAE part

- Visualization of the hidden variables.

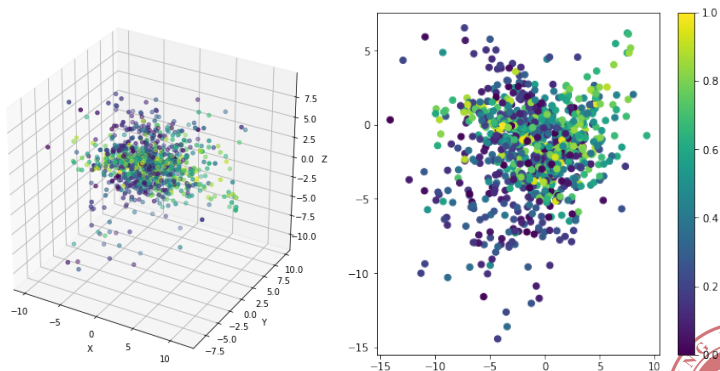


Figure: With 3 hidden units(left) and 2 hidden units(right)



On the SDSS dataset

- Visualization of the hidden variables.

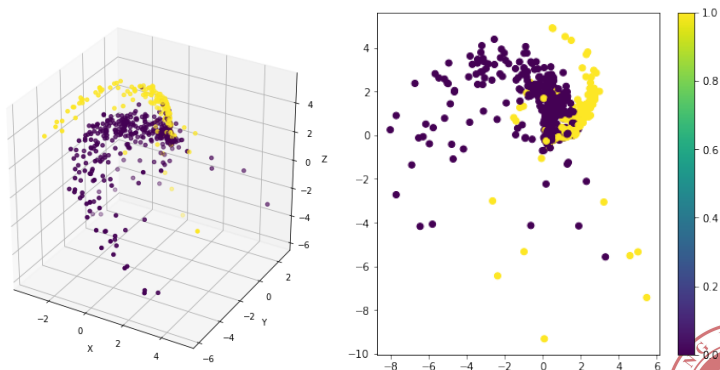


Figure: With 3 hidden units(left) and 2 hidden units(right)



MCMC scale expansion: Problems last week

- Definition of "real configurations"/ baseline

Correlation function/correlation length

The figures below show correlation function of 32×32 spin configurations generated by MCMC and by neural nets.

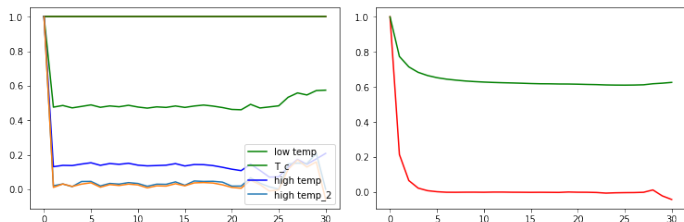


Figure: Corr-func of configs generated from VAE(left) and MCMC(right)

- Mode collapse



What's wrong here

- When I use VAE to train a generator, the goal of the generator is to minimize the loss function, which represents no physical interaction information.
 - 1 Use artificial convolution kernel to extract the local interactions.
 - 2 Use GANs

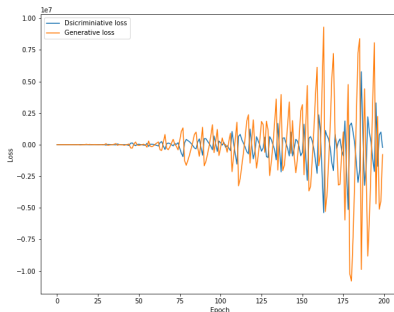


Figure: Loss of wgan(200 epochs)



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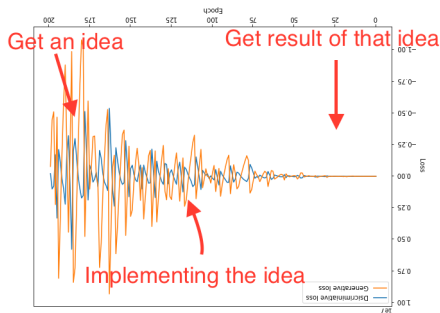


Figure: Heart beat when I have a idea, and after implement it

