Computation for Data Compression, Image and Signal Analysis 01/12/2023

Course Overview

- Computation
  - backpropagation
    - algorithm to train neural networks
      - Multilayer Perceptron
      - Autoencoders (main part of course)
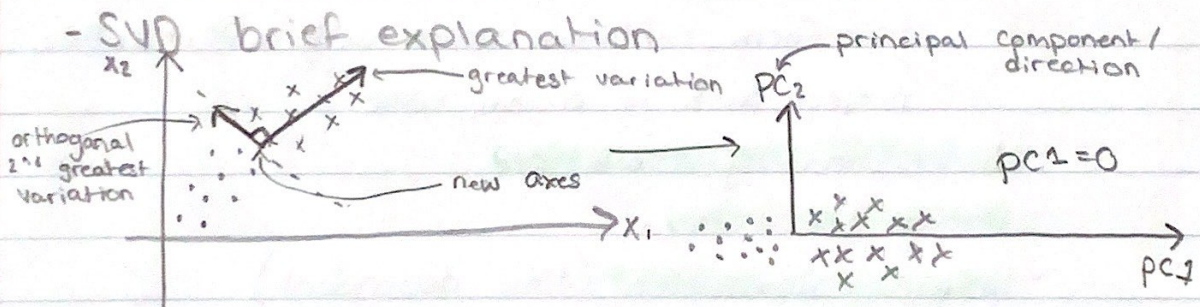   - CNN Autoencoders
- data compression
  - linear data compression
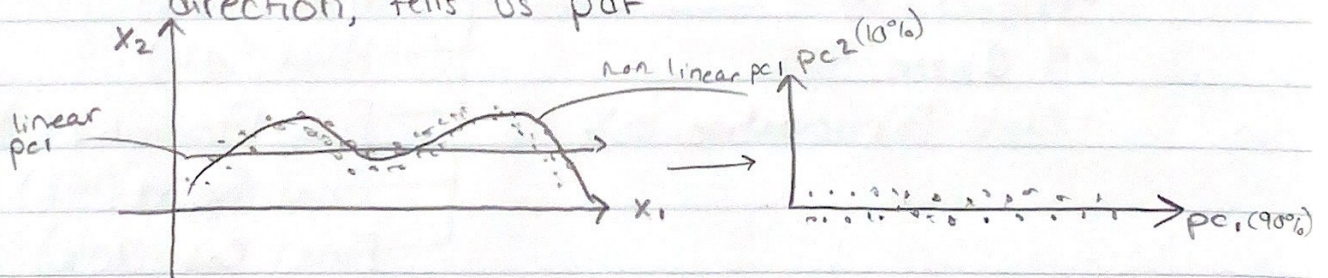   - singular value decompression (SVD)
  - nonlinear data compression
    - Autoencoder (AE)
    - Variational Autoencoder (VAE)
  - SVD brief explanation

  - Nonlinear data compression brief explanation
    - allows for data with no linear principal direction, tells us pdf

- <mark>image and signal analysis</mark>
  - application
- applications
  - however much time allows
  - may have classes related to projects
  - linear
    - <mark>image compression</mark>
    - <mark>image encoding</mark>
    - dimensionality reduction <mark>(Principal Component Analysis (PCA))</mark>
  - nonlinear
    - <mark>image compression</mark>
    - <mark>data sampling</mark>
      - transform nonlinear space with $x_1 PC_1 + x_2 PC_2$, project back to original space
    - <mark>dimensionality reduction</mark>
    - <mark>image search</mark>
    - <mark>image colorization</mark> (time dependent)
      - requires lots of training data
- grading breakdown
  - Project: 50% ————————— HW1 (10%)
  - 4 Quizzes: 40% ————————— HW2 (10%)
  - Class Participation: 10% ————————— Final Presentation (10%)
  ————————— Final Report (10%)
  ————————— Final Code (10%)

- deep generative model
  - VAE
  - generative adversarial networks (GANs)
  - energy based models
  - flow based models
- Project
  - either go deeper into VAE or combine VAE with generative adversarial networks, energy based models, or flow based models