Adversarial Subsampling. by Chieh Wu
Thursday, December 7, 2023 12:06 PM

- eigenvector of a kernel can be obtained from eigenfunction and vice versa (Rosaso)
- Given a "fixed kernel" we can
  1. Obtain the eigen functions
  2. If we only keep the leading eigenfunctions. and remove the weak eigenfunctions, supervised training results shouldn't change much. Also, we should be able to bound the error.
- Eigenfunctions are from integral operators.
- Integral Operators can be approximated via samples.
- Given N total Samples that gives us
  1. The kernel matrix
  2. It's corresponding eigenfunction.
- If $n \ll N$ samples yields approximately the same eigenfunctions.
- Then n samples would be sufficient to train supervised learning.
- This allows us to obtain a small subset of data that can be trained much faster.
  - Try multiple algorithms quickly.

- Given V_1 as leading eigenvector of K
- Let

$$u_1 = \begin{bmatrix} \phi(x_1)^T \\ \phi(x_2)^T \\ \vdots \\ \vdots \end{bmatrix} \quad f_1 = \begin{bmatrix} K(x_1, ?) \\ K(x_2, ?) \\ \vdots \end{bmatrix}$$

where f_1 is an we wish to learn

- We want to find f_1 such that

$$\min_{f_1} \|u_1 - V_1\|^2$$

- This would allow us to generate a sample that maximally align to the eigenfunction.
- Given the residual error as

$$\varepsilon_1 = u_1 - V_1$$

- The next sample u_2 will be generated to minimize ε_1
- This process continues until $\varepsilon <$ some value.