EE5605: Kernel Methods, Spring 2019 (56)
Indian Institute of Technology Hyderabad
HW 2, 50 points. Assigned: Thursday 25.04.2019.
Due: Wednesday 01.05.2019 at 11:59 pm.

1. In our discussion of kernel PCA we stated the following result: $\tilde{\mathbf{K}} = \mathbf{K} - 2\mathbf{1}_{1/n}\mathbf{K} + \mathbf{1}_{1/n}\mathbf{K}\mathbf{1}_{1/n}$. Prove this result. Why is this a useful result? Use notation from class. (5)

2. State and prove the representer theorem. (5)

3. Apply the representer theorem to solve the kernel ridge regression problem. Derive the solution and clearly show each step. (5)

4. Apply the representer theorem to solve the kernel SVM problem. Again, derive the solution and clearly show each step. (5)

5. Implement the vanilla (linear) and kernel versions of principal component analysis (PCA). To demonstrate the utility of kernel PCA, generate data points for which the vanilla PCA fails while kernel PCA works. Clearly describe how you generated your data points. (20)

6. Implement kernel ridge regression by kernelising the linear ridge regression predictor. Demonstrate the benefit of kernelising this problem using noisy sinusoidal data points. (10)