Detect: Divergence between train and test

Identify: Specific examples for the discrepancy

Two-Sample Tests using Kernel Divergences

- Probability measures are μ, ν ∈ P(X)
- The empirical measures are \( \hat{\mu} = \sum \nu \delta_{x_i} \) and \( \hat{\nu} = \sum \nu \delta_{y_i} \)

Maximum mean discrepancy (MMD)

\[
\text{MMD}(\mu, \nu) = \text{sup}_{u} \langle \mathbf{u}, \mathbf{X} \rangle - \text{sup}_{\mathbf{w}} \langle \mathbf{w}, \mathbf{X} \rangle = \text{sup}_{\mathbf{u} \in \mathbb{R}^2} \langle \mathbf{u}, \mathbf{X} \rangle
\]

The max-sliced kernel Wasserstein-2 (W2)

\[
W_2^2(\mu, \nu) = \max_{A : \mu A = \nu} \left\{ \sum_k \left( \int_k \mathbf{x} \mathbf{w} \right)^2 \right\}^{1/2}
\]

Proposed Methods: Kernel Landmarks

- Landmark max-sliced kernel Wasserstein (L-W2)
  At most l = 2k evaluations each require O(k log N)

- Landmark max-sliced kernel Bures (L-Bures)
  At most l = 2k evaluations each require O(N)

Detecting Data Changes using Different Learning Representations

No Reduction (NoRed): which is the raw data
Principle Component Analysis (PCA): \( X = XR \)
Sparse Random Projection (SRP): \( X = XR \)
Autoencoders (AE): [Untrained (UAE) & Trained (TAE)] \( h = \phi(x) \)
Black Box Shift Detection (BBSD): using softmax outputs

Perturbation: Gaussian Noise (SNR=0.4)