**Maximum Likelihood Estimation with Gaussian Mixture Noise**

Model estimation at a Gaussian mixture:

- **For each i.i.d. additive noise:**
  \[ \sum_{y|z} = \sum_{y|x} \pm \sum_{z} + 2 \]
  \( \mu_{z} \) estimation of the low-rank subspace (PCA) is consistent in the presence of any i.i.d. additive noise with finite variance.

- **Independent, non-identical additive noise:**
  \[ \sum_{y|z} = \sum_{y|x} + 2 \]

  When we consider additive noise in a multiple channel setup, we can build an ML estimator that is consistent in the presence of independent Gaussian noise. We do not need any assumptions about the distribution of the noise.

- **Relaxing Gaussian noise:**
  Linear Additive mixture:

  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  We do not need to make any assumptions about the distribution of the noise. We use a flexible approach to estimate the conditional distribution of the noise.

- **Weighted Low Rank Approximation:**

  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  Weighted Low Rank Approximation with...

  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  and aptitude mixture parameters.

**Non-Additive Models:**

- **L2 Approach:**
  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  L2 Approach to low-rank approximation: cross-product distance to PCA. Subspace estimated by the leading a eigenvalues of empirical covariance of g.

- **Maximum Likelihood Low-Rank estimation with non-Gaussian noise:**
  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  Maximum Likelihood Low-Rank estimation with GNP noise is not, in general, consistent.

**Consistency of Maximum Likelihood Estimation with a Known Noise model**

General Conditions:

- **Non-Additive Noise:**
  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  The ML estimator is not consistent!

- **Logistic Low-Rank Approximation:**
  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  Logistic Low-Rank Approximation (MLR): a problem.

  \[ \sum_{y|x} = \sum_{y|z} + 2 \]

  Maximum Likelihood Low-Rank estimation with non-Gaussian noise is not, in general, consistent.

**Challenge:** Find a consistent estimator for the low-rank subspace of natural parameters.