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Unsupervised Speaker Diarization Using Riemannian Manifold Clustering

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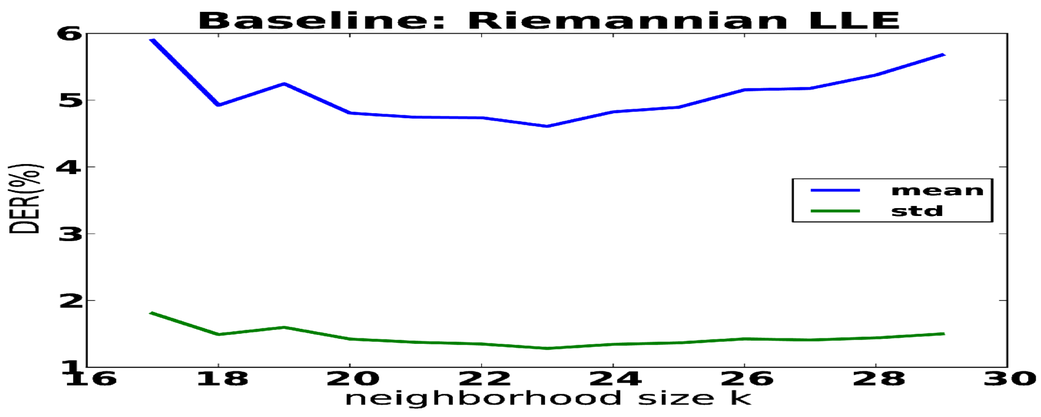
Motivation

- To perfectly cluster short segments
  - Likelihood-based clustering not good on short segments
- Geometric viewpoint
  - Non-convexity of speaker clusters
  - Faithful geodesic metric
- Speaker clustering by Riemannian manifold clustering
- Suppress sparsity issue in local samples
- Stabilize performance over parameters
- **Hypothesis**: speech segments from different speakers form distinct (sub-)manifolds

Baseline

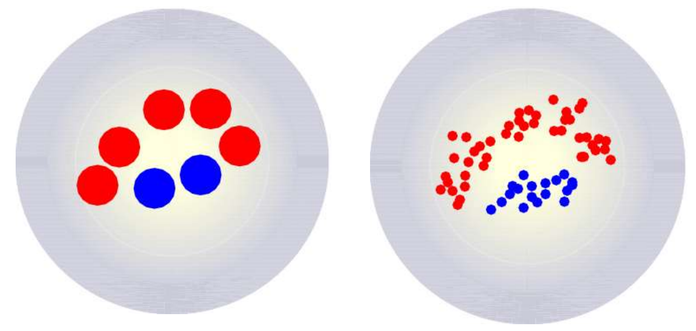
- Riemannian Locally Linear Embedding (LLE) as the baseline
  - Each segment as a single Gaussian
  - Similarity matrix constructed by local distances to neighbors
  - Graph Laplacian for spectral clustering
- Test on 2477 5-min microphone interviews from NIST 2010 (~206hrs)



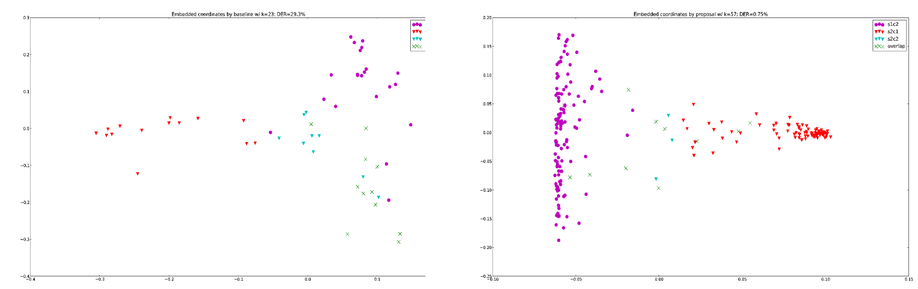
- Best at k = 23 w/ DER= 4.607%
- Issues
  - Choice of neighborhood size k
  - GMM vs single Gaussian modelings

Proposal

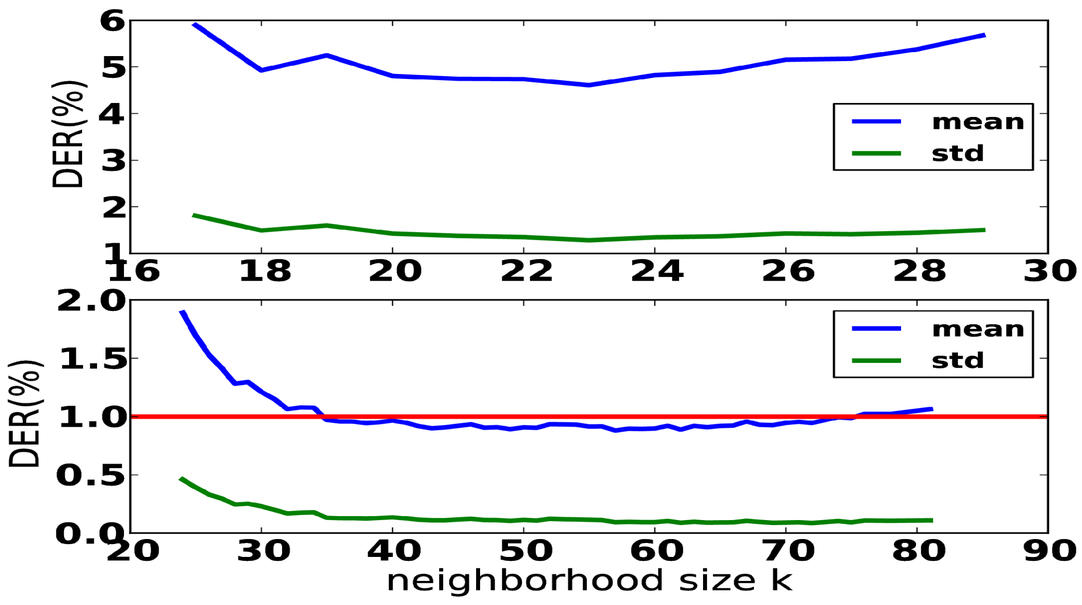
- Sparsity of local samples hides clusters' structure
- **Proposal**:
  Impose a length constraint on segments
- Advantages
  - Short segment suitable for single Gaussian
  - Increase local sample density
  - De-sensitize performance over k
- Disadvantage
  - Potential increase in computation complexity
- Schematic diagram



- Dense local samples reveal clusters' structure
- Embedded coordinates for a particular section



Comparison



- 1s length constraint
- Best at k = 57 w/ DER= 0.88%
- Stable under 1% for wide range of k

Discussion & FutureWork

- Effective Riemannian manifold modeling for speech segments
- Performance less sensitive over parameter tuning at the cost of potentially higher complexity
- In the future, to consider noisy segments and the number of speakers estimation

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