Mid Evals - SMAI

Team Number: 55 | Team Bash Party

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Copy of Timeline

Timeline	Milestones	Status
@November 1, 2021 → November 7, 2021	Literautre Review	Completed
@November 7, 2021	Project Proposal Submission	Completed
@November 7, 2021 → November 10, 2021	Creation of pipeline and preparing dataset	Completed
@November 11, 2021 → November 12, 2021	Run PCA on Datasets	Completed
@November 13, 2021	Running other DRAs	Completed
@November 14, 2021 → November 16, 2021	Convert Euclidean distances into conditional probabilities that represent similarity	Facing Difficulties, Ongoing
@November 17, 2021 → November 20, 2021	Mid Project Evaluations	Completed
@November 21, 2021 → November 27, 2021	Implementing improvements and suggestions based on mid evals	TBD
@November 28, 2021 → November 29, 2021	Testing	TBD
@November 30, 2021	Write Report and make presentation	TBD
@December 1, 2021 → December 4, 2021	Final Presentation	TBD
@December 4, 2021	Final Report submission	TBD

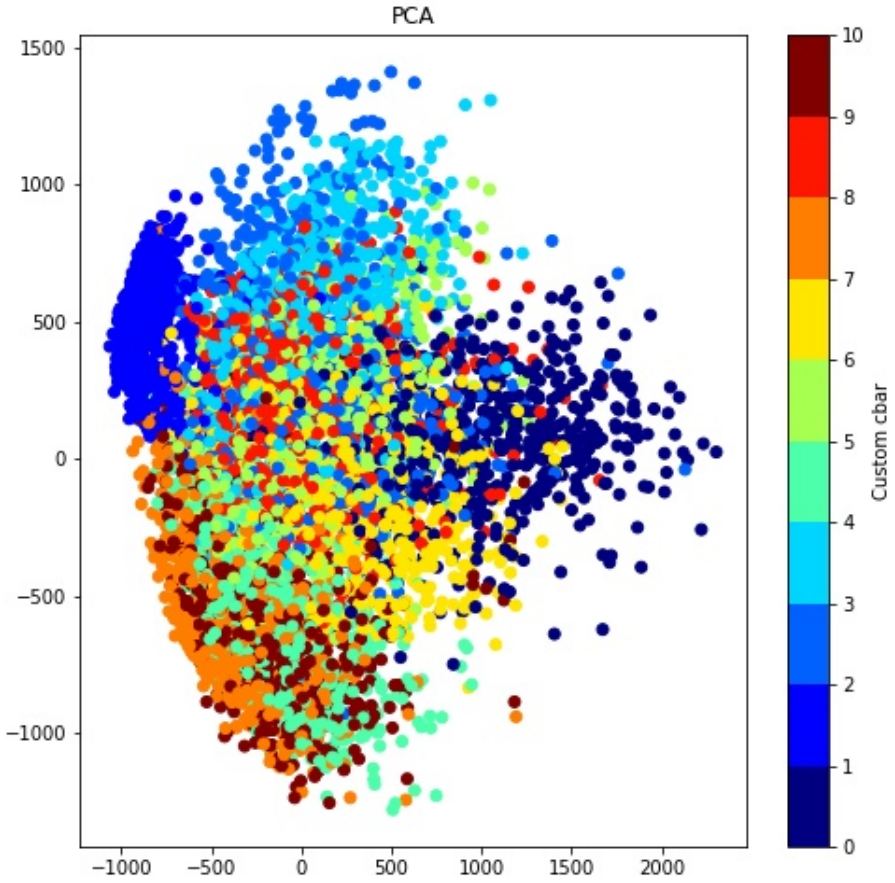
Work Done till Now

- Literature Survey: We explored and studied different dimensionality reduction techniques used for transforming and visualizing high dimensional data.
- Dimensionality Reduction Techniques: We explored and studied different dimensionality reduction techniques used for transforming and visualizing high-dimensional data.
    - Principal Component Analysis: is used to explain the variance-covariance structure of a set of variables through linear combinations. It is often used as a dimensionality reduction technique. It is the process of computing the principal components and using them to perform a change of basis on the data, sometimes using only the first few principal components and ignoring the rest.
    - Sammon Mapping: **Sammon mapping** or **Sammon projection** is an algorithm that maps a high-dimensional space to a space of lower dimensionality by trying to preserve the structure of inter-point distances in high-dimensional space in the lower-dimension projection.
    - Isometric Mapping: **Isomap** is a non-linear dimensionality reduction method. It is one of several widely used low-dimensional embedding methods. Isomap is used for computing a quasi-isometric, low-dimensional embedding of a set of high-dimensional data points. The algorithm provides a simple method for estimating the intrinsic geometry of data manifold based on a rough estimate of each data point's neighbours on the manifold. Isomap is highly efficient and generally applicable to a broad range of data sources and dimensionalities.

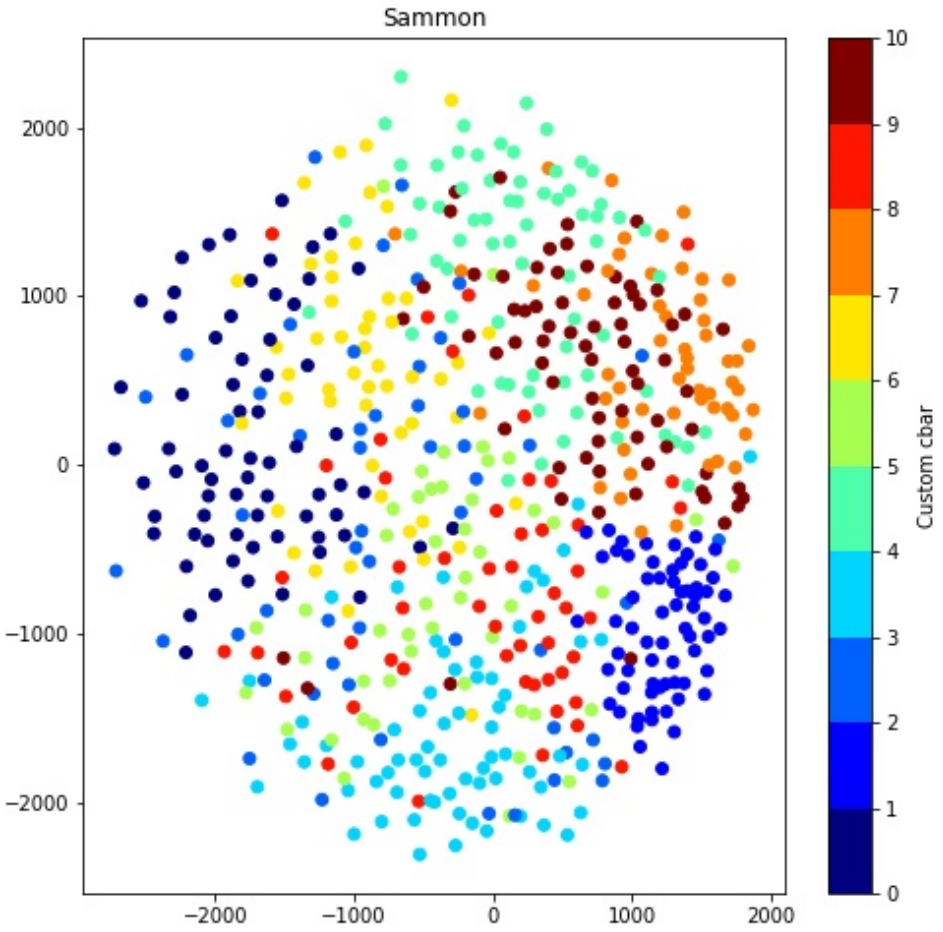
- Understanding MNIST and Olivetti Face Datasets: We used two datasets to try out the above-mentioned DR techniques to understand their working.
    - MNIST Dataset: The MNIST(Modified National Institute of Standards and Technology) database consists of handwritten digits. It has a training set of 60,000 examples and a test set of 10,000 examples. It is a subset of a larger set available from NIST. The digits have been size-normalized and centred in a fixed-size image.
    - Olivetti Faces Dataset: This dataset contains a set of images of faces taken between April 1992 and April 1994 at AT&T Laboratories Cambridge. There are ten different images of each of 40 distinct subjects. For some subjects, the images were taken at different times, varying the lighting, facial expressions (open/closed eyes, smiling / not smiling), and facial details (glasses / no glasses). All the images were taken against a

dark homogeneous background with the subjects in an upright, frontal position (with tolerance for some side movement).

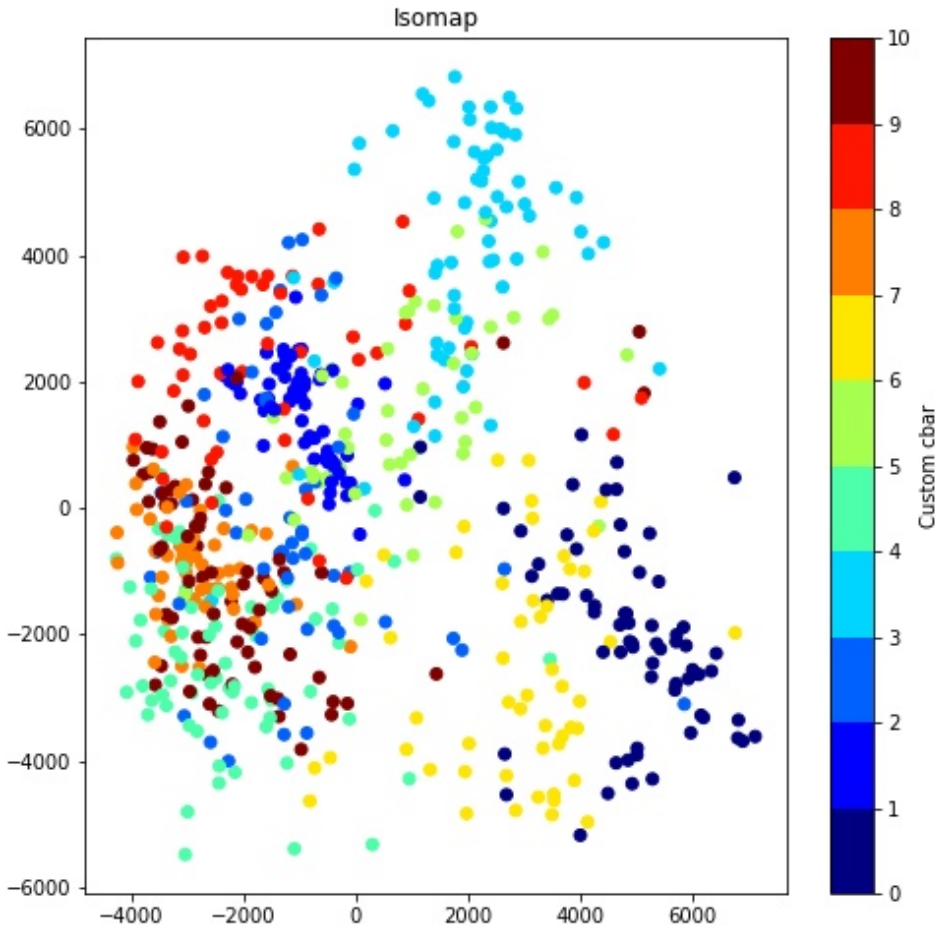
- Ran PCA, Sammon, Isometric Mapping on MNIST and Olivetti Faces datasets for dimensionality reduction.
    - MNIST and Olivetti Faces
        - Reduced the initial 784 dimensions to 2 using Principal Component Analysis (Visualization shown below)
        - MNIST Dataset (subsample of 600 points reduced to 2 dimensions using PCA)
        - Reduced the initial 784 dimensions to 30 using PCA
            - PCA after reducing dimensions from 784 to 2



- Sammon Mapping to reduce 30 dimensions to 2 for visualisation

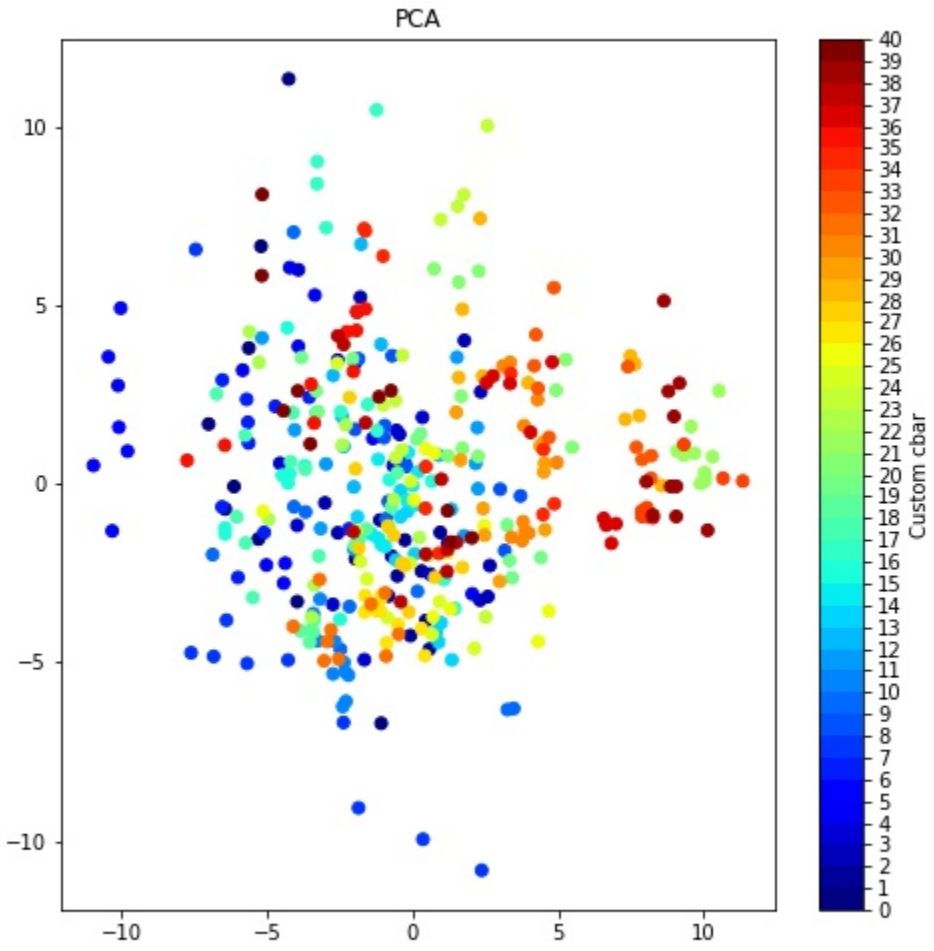


Isometric Mapping to reduce 30 dimensions to 2 for visualization

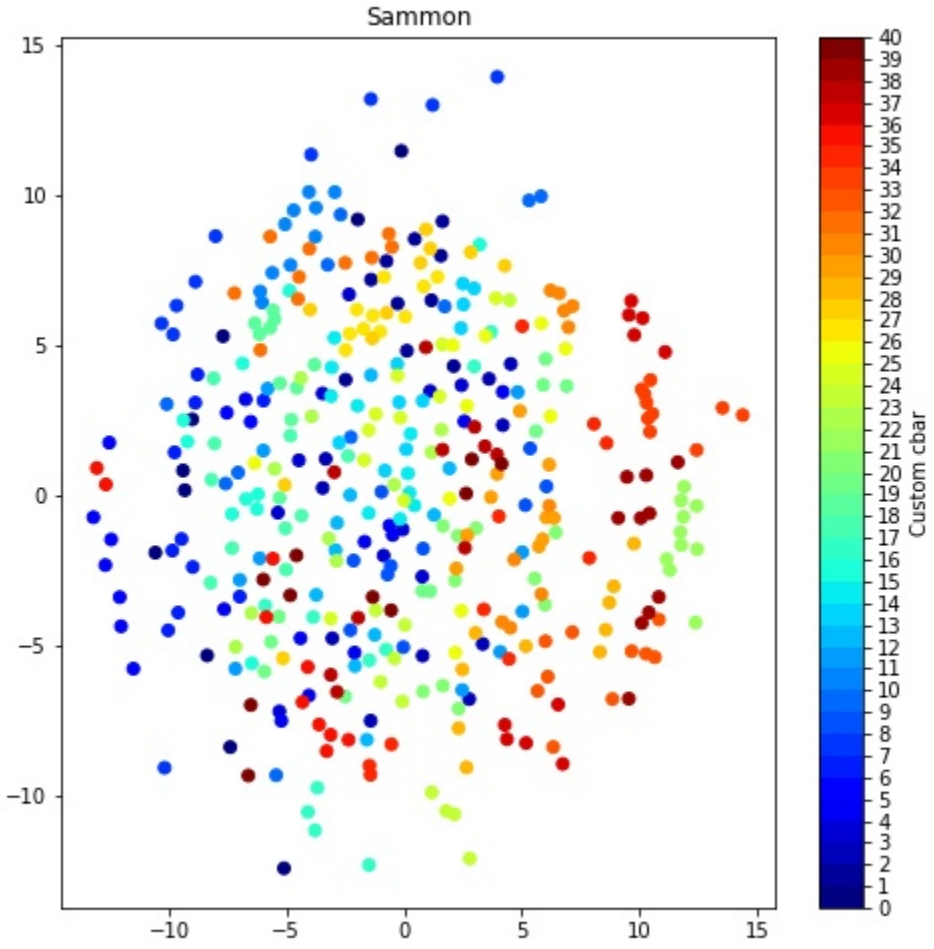


Olivetti Dataset

- Ran PCA on Olivetti Dataset to reduce 4096 dimensions to 2



- Ran PCA to reduce 4096 dimensions to 30. Then ran Sammon and isometric mapping for visualization.


Sammon
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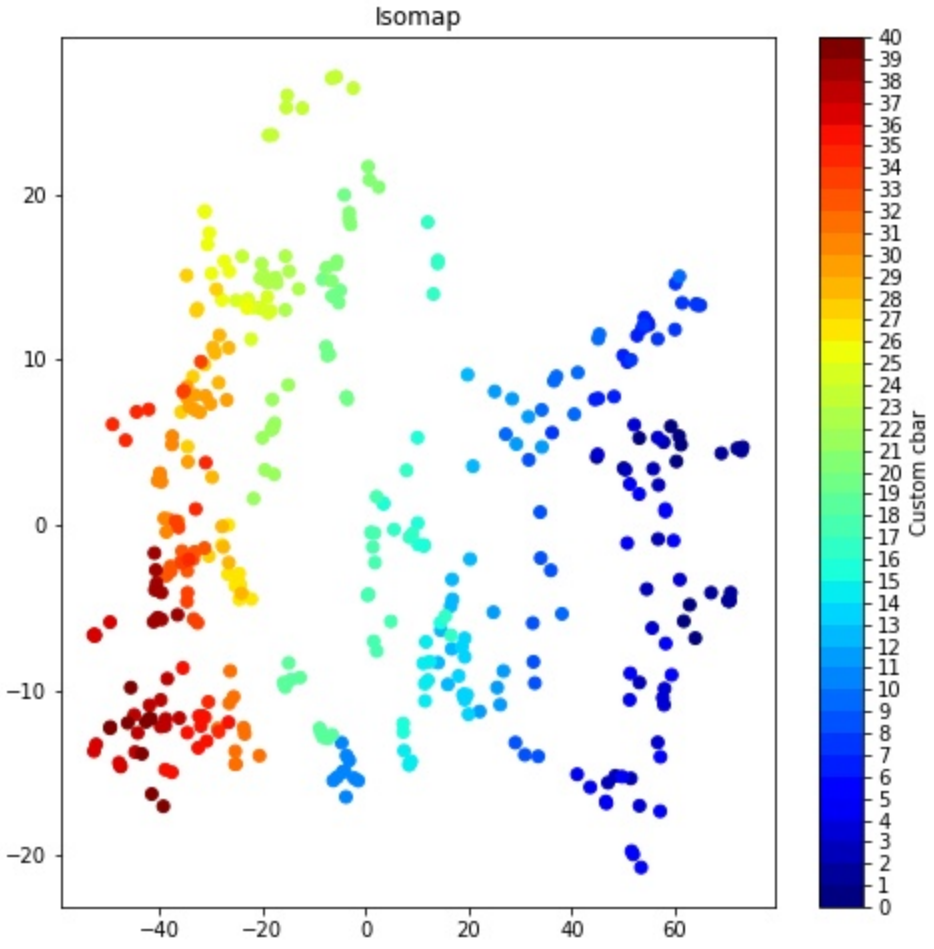

Future Work

To have a quantitative and qualitative understanding of the pros and cons of **t-SNE**. When it would be a good idea to use it, and when it would not be a good idea. We would have a working implementation of:

- **t-SNE:**
  - Code
  - Scatterplots for different datasets
- **Modified t-SNE:**

- Code
- Scatterplots for different datasets