

Interactive Exploration of Dense Map

Dense map is a recent method to show decision boundaries of machine learning classifiers, first proposed by Rodrigues et al[1]. In general, such boundaries are implicitly shown by drawing 2D scatterplots of the training set with observations colored by assigned class labels, using dimensionality reduction methods, as shown in Fig 1a. However, since such sets are sparse (have relatively few observations), decision boundaries are only implied in the 2D areas where points with different labels meet. Scatterplots utilize the projection results of the original feature spaces from R^n to R^2 but can not explicitly show the actual decision boundaries. In contrast, dense map simulates the inverse projection process from R^2 to R^n to color every pixel $y \in R^2$ of the target image to represent information pertaining to it in the original feature space R^n . Rodrigues et al.[1] construct dense map by scattering and gathering approaches as shown in Fig 1b and 1c. The final dense map shows like Fig 1d. Other related literature can be found in [2].

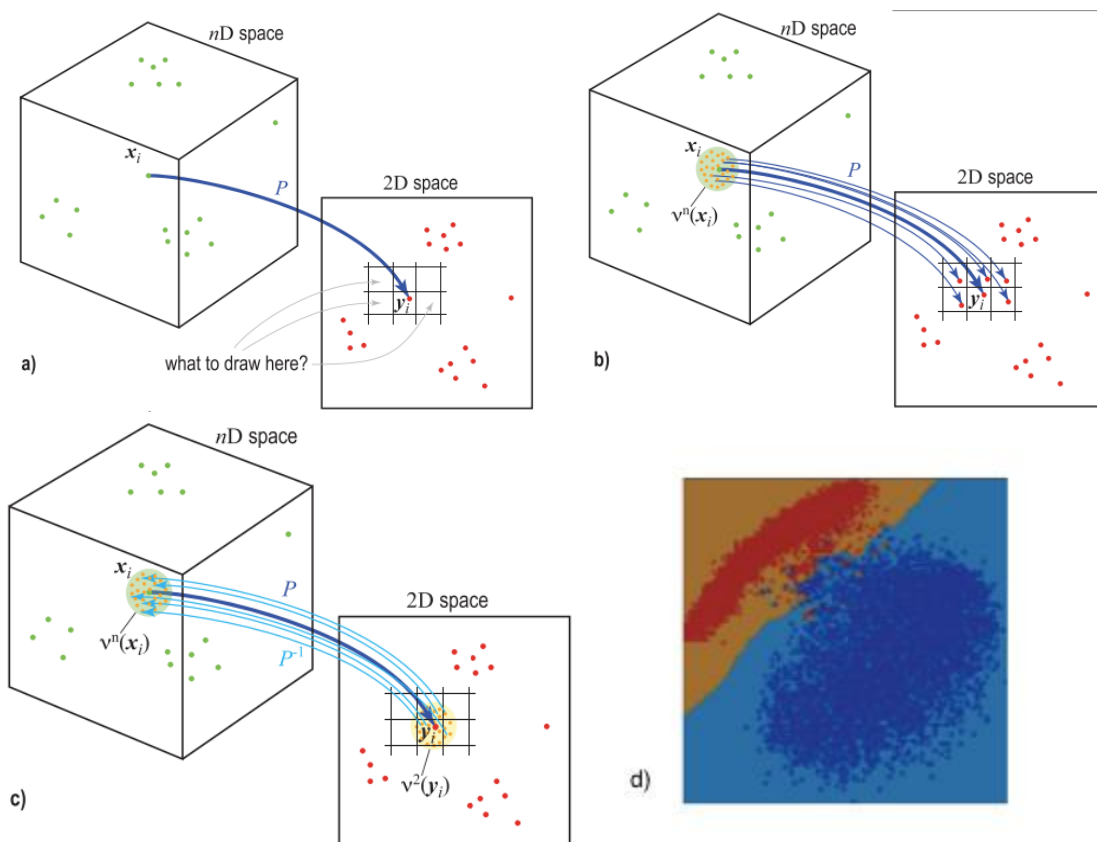


Fig 1. a) Scatterplot problem. Dense map construction by scattering(b) and gathering(c) approaches.

In this project, you are expected to implement an interactive system to display dense map, and support the exploration of dense map and its corresponding original feature space. For example, you can select a pixel or region on dense map, and then observe and analyze what data it represents in the original feature space. You can also consider other interaction operations such as filtering etc. The suggested dataset is MNIST[3]. You can choose the projection methods as you like or make your system support multiple projection methods. If you use image datasets like MNIST, the expected result to see corresponding to every pixel is also an image.

References:

- [1] F. C. M. Rodrigues, R. Hirata and A. C. Telea, "Image-Based Visualization of Classifier Decision Boundaries," 2018 31st SIBGRAPI Conference on Graphics, Patterns and Images (SIBGRAPI), Parana, 2018, pp. 353-360, doi: 10.1109/SIBGRAPI.2018.00052.
- [2] Espadoto, Mateus, Francisco Caio M. Rodrigues, and Alexandru C. Telea. "Visual Analytics of Multidimensional Projections for Constructing Classifier Decision Boundary Maps." VISIGRAPP (3: IVAPP). 2019.
- [3] <http://yann.lecun.com/exdb/mnist/>