

Scientific and Large Data Visualization
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Objects Arrangement

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Objects Arrangement

Motivations

- Multidimensional reduction can be used to arrange objects in 2D or 3D preserving pairwise distances (but the final placement is arbitrary).
- Many applications require to place the objects in a set of pre-defined, discrete, positions (e.g. on a grid).

Example – Images of Flowers



Random Order

Example – Images of Flowers



Isomap

Example – Images of Flowers



IsoMatch (computed on colors)

Problem Statement

The goal is to find the permutation π that minimizes the following energy:

$$E_p(\pi) = \min_c \left(\sum_{i,j} cd(i, j) - d(\pi(i), \pi(j)) \right)^{\frac{1}{p}}$$

Permutation

Original pairwise distance

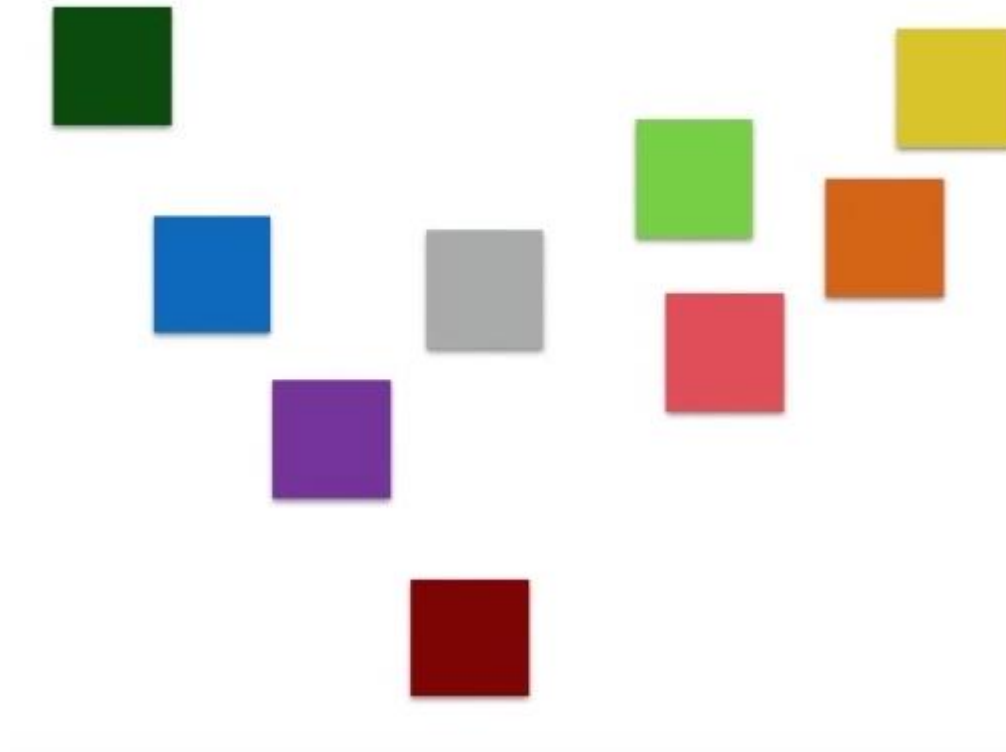
Euclidean distance in the grid

IsoMatch – Algorithm

- Step I : Dimensionality Reduction (using Isomap)
- Step II : Coarse Alignment (bounding box)
- Step III : Bipartite Matching
- Step IV (optional) : Random Refinement (elements swap)

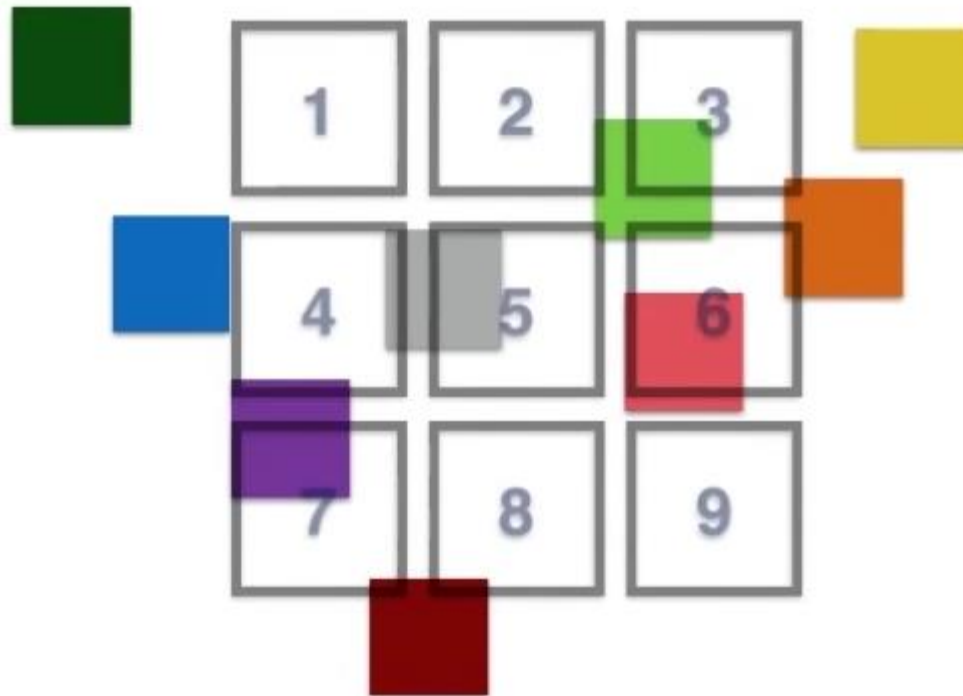
Algorithm – Step I

Dimensionality Reduction



Algorithm – Step II

Coarse Alignment

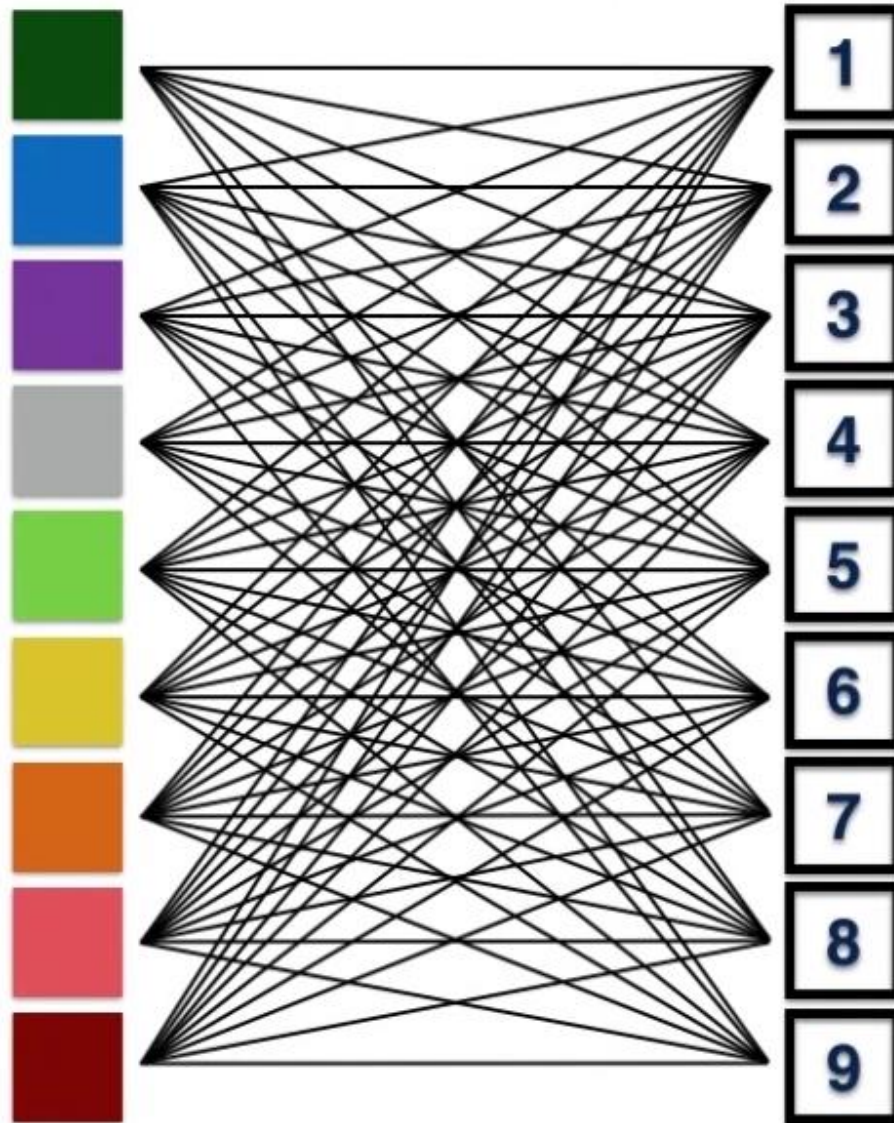


Bipartite Matching

- A complete bipartite graph is built (one with the starting locations, one with the target locations)
- The arc (i,j) is weighted according to the corresponding pairwise distance.
- A minimal bipartite matching is calculated using the Hungarian algorithm.

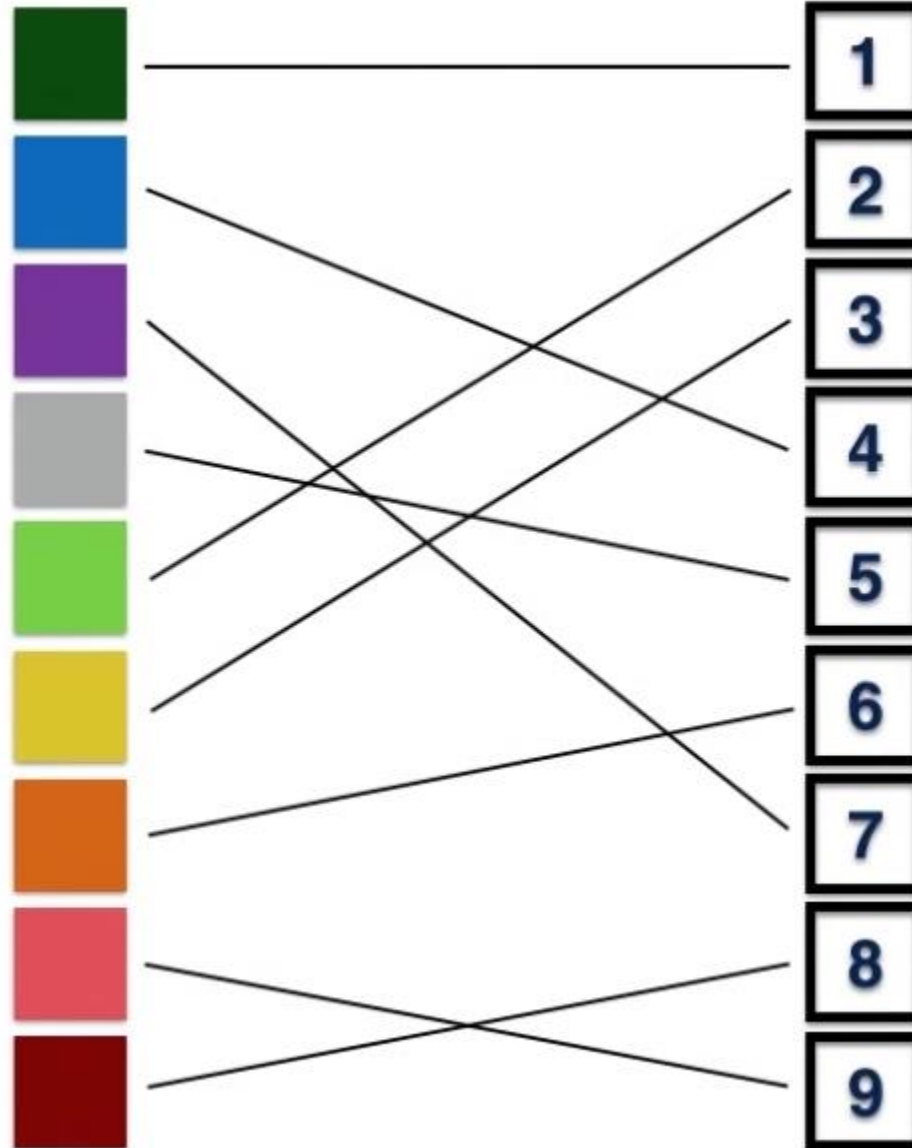
Algorithm – Step III

Bipartite Matching (graph built)



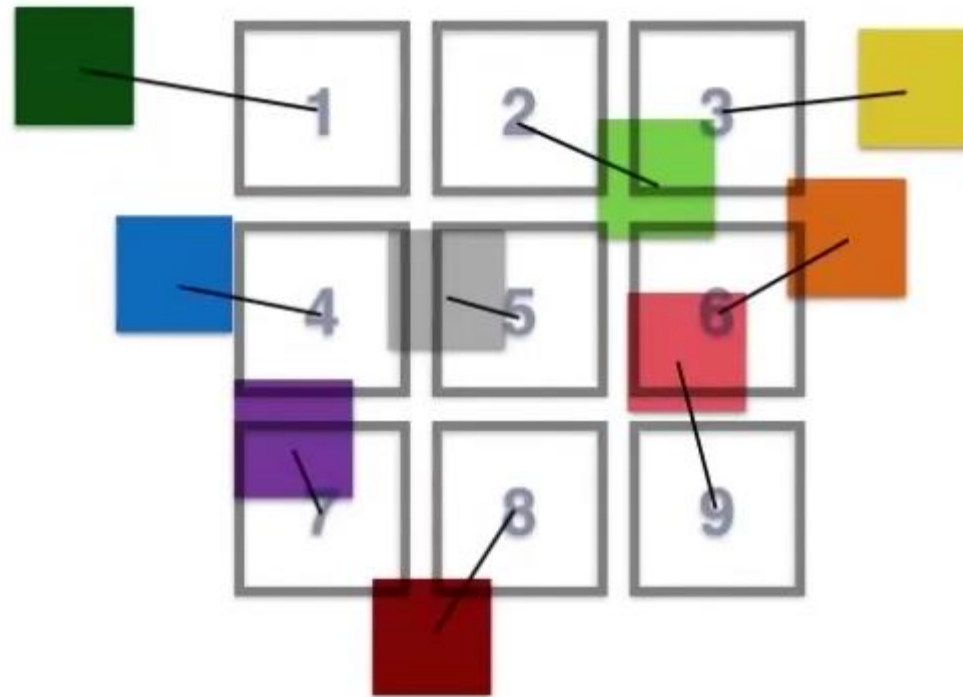
Algorithm – Step III

Bipartite Matching



Algorithm – Step III

Final Assignment





Average Colors



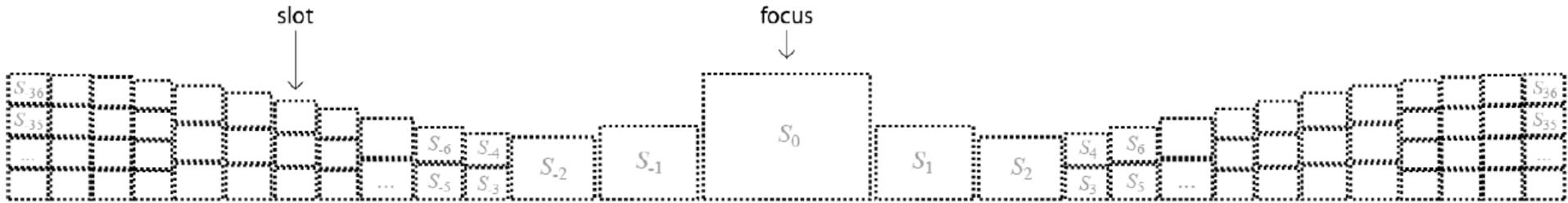
Word Similarity

PileBars



- A new type of thumbnail bar.
- Paradigm: *focus + context*.
- Objects are arranged in a small space (images are subdivided into clusters to save space).
- Support any image-image distance.
- PileBars are *dynamic* !

PileBars – Layouts



Slots



1 image



2 images



3 images



4 images



12 images

PileBars

- Thumbnails are dynamically rearranged, resized and reclustered adaptively during the browsing.
- This is done in a way to ensure *smooth transitions*.

PileBars - Application Example

Navigation of Registered Photographs



Take a look at <http://vcg.isti.cnr.it/photocloud> .

Questions ?