Vision in Human and Machine - Tutorial 5
Hierarchical Recognition Models

Heiko Wersing

1 Nearest neighbor classifier: Exemplar-based recognition

One of the simplest ways of performing classification based on a number of classified training vectors is the nearest-neighbor classifier (NNC): If you get an unlabeled test vector to classify, find the training vector with closest distance to the test vector and label the test vector according to the label of the 'nearest neighbor' training vector. Implement a nearest neighbor classifier that selects a given subset of n training vectors (evenly distributed on the object viewing angles), and classifies the remaining vectors. The input vectors are obtained from the `dataset` construction, which is carrying the feature activations of all COIL100 images. The comparison is done between activation maps of corresponding views. The comparison should thus be based on a difference computation of the form

```
   dif=dataset(:,:,:,train_view_index)-dataset(:,:,:,test_view_index);
distance=sum(sum(sum(dif.* dif)));
```

Write a function
`classify_dataset(dataset_name_code,num_objects,num_training_views)`
that performs a nearest neighbor classification experiment for a saved arbitrary dataset. Use the corresponding function to evaluate the performance of nearest-neighbor classification in the different stages of the hierarchy you have set up in Tutorial 3. Compare the performance of the "retinal" input layer carrying the images, S1, C1, S2, and C2 (set up analogously to C1) representations by using the corresponding dataset for doing the nearest neighbor experiment. Try to optimize your hierarchy for its classification performance.

2 Similarity Matrices

Modify your nearest neighbor computation such that the routine iterates over all view activation vectors in the dataset and computes a matrix `distance_matrix(view1,view2)=dif` between all available views (maybe choose less than 100 objects, otherwise it gets too large). Visualize the distance matrix using `imagesc` and try to understand the resulting pattern.