**Results**

To set the baseline for neural networks, kNN classifier with cropped images has been used. The cropped and rotates containing only the nose of the whale were used (image size 256 x 256. See above for details).

Firstly kNN classification was applied to raw feature vectors i.e. vector of unrolled image pixel values. A number of different k values have been used, namely k=1, 3, 5, 7 and 9. Euclidean distance was used as a measure of similarity. The same train + validation data split as for ANN has been applied to test the kNN classifier, so this way results would be comparable.

The accuracy achieved with this setup was relatively poor – the best accuracy was for k=1. Full table below.

In order to improve accuracy, a couple of different dimensionality reduction and feature extraction techniques have been performed. The first one was PCA. After applying PCA, the size of the feature vector in the PCA feature space has been reduced nearly 80 times (from 65536 to 831 features). The number of principal components has been further reduced to only account for around 92% of variance in the data. The resulting FV for an image was [1 200].

Results indicate there was a slight increase in accuracy after PCA analysis. The accuracy has increased to for k=1. Nevertheless, the performance of such classifier is far for satisfactory.

Further feature extraction has been performed using Linear Discriminant Analysis (LDA). Using the combination of PCA and LDA has shown significant improvement in the results. The accuracy has increased to for k=1. Through experimental trials the accuracy has been further increased by changing similarity measure to ‘Chebychev distance’. It is hypothesized, that in LDA feature space Chebychev distance gives advantage over Euclidean, as it only takes into account the most significant feature. With the latter setting, the accuracy was for k=9

Below is the full table of kNN classification results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| kNN classification results.. #Runs = 20 per k | | | | |
| **k** | **RAW** | **PCA** | **PCA+LDA** | **PCA+LDA (chebychev)** |
| k=1 | 0.2097 | 0.2419 | 0.5726 | 0.5968 |
| k=3 | 0.1290 | 0.1371 | 0.5484 | 0.6048 |
| k=5 | 0.1290 | 0.1452 | 0.5242 | 0.6129 |
| k=7 | 0.1290 | 0.1210 | 0.4677 | 0.5806 |
| k=9 | 0.0968 | 0.1129 | 0.4919 | 0.6210 |