Supplementary Materials for "Mixture Component Identification and Learning for Visual Recognition"
Paper ID: 1465

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Figures 1 - 4 depict the $(2, K^E_{\text{MMI}})$-Spectral Projection of the aeroplane 1, bicycle2, bus 3 and person 4 classes. The figures are acquired using the same approach as for Fig. 1 in the paper: 2D coordinates are acquired by $(2, K^E_{\text{MMI}})$-Spectral Projection and colors represent associations to top 4 out of 5 clusters (acquired by k-means on the $(5, K^E_{\text{MMI}})$-Spectral Projection representation). Here, similar to the paper, "top clusters" are those which have highest average kernel similarity between samples assigned to them.

It can be observed that for the classes with small intra class variation e.g. mainly viewpoint variation, the 1 dimensional degree of freedom in $(2, K^E_{\text{MMI}})$-Spectral Projection representation (angle) captures the variation in the underlying variation source. However, if the class has high intra class variation e.g. in case of person: articulation and sub-category (standing, riding a bike, sitting, etc), the 1 dimensional degree of freedom is basically not sufficient to capture a smooth transition between variations. However, by projecting the data to higher dimensions e.g. $\{(5, K^E_{\text{MMI}}), (10, K^E_{\text{MMI}})\}$-Spectral Projection (used for clustering), the ℓ_2 distance becomes a good approximation of the visual similarity. This can be verified by looking at the cluster centers and the learnt filters for each cluster (see Figures 11 and 12). The same fact can be observed for other classes: aeroplane (5, 6), bicycle (7, 8) and bus (9, 10). In Figures 5 - 12, "top image of a cluster" refers to images associated with a cluster that have highest average kernel similarity to other images associated with the same cluster.

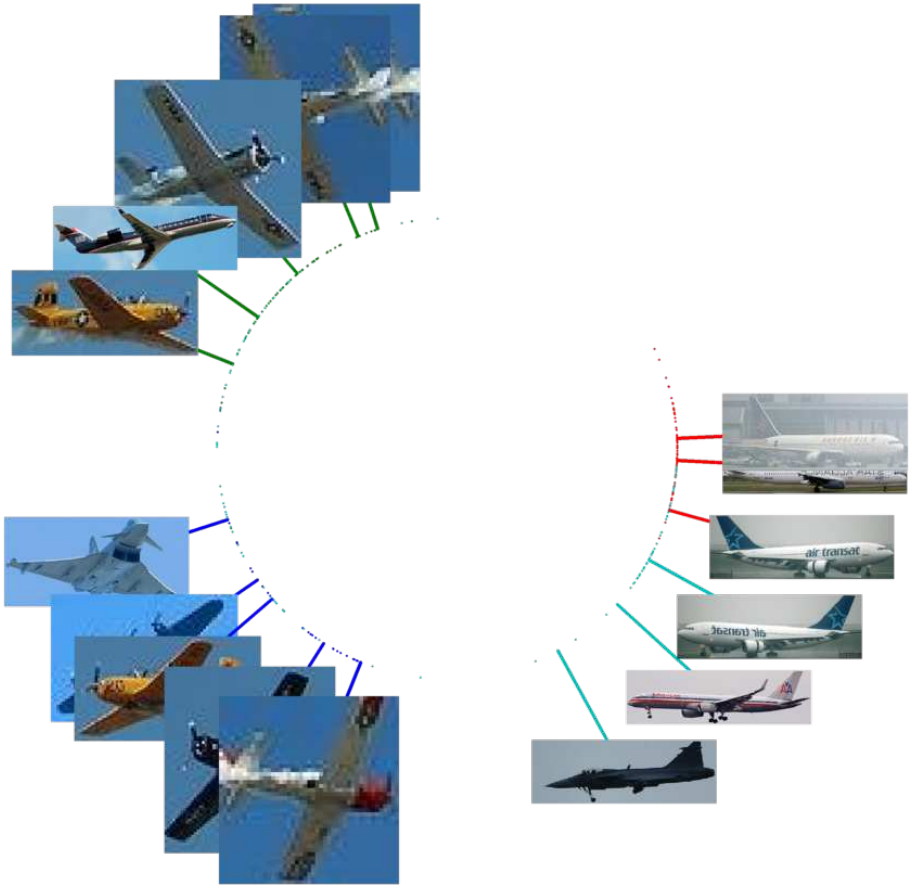

Figure 1: Visualization of $(2, K^E_{\text{MMI}})$-Spectral Projection of the aeroplane class.

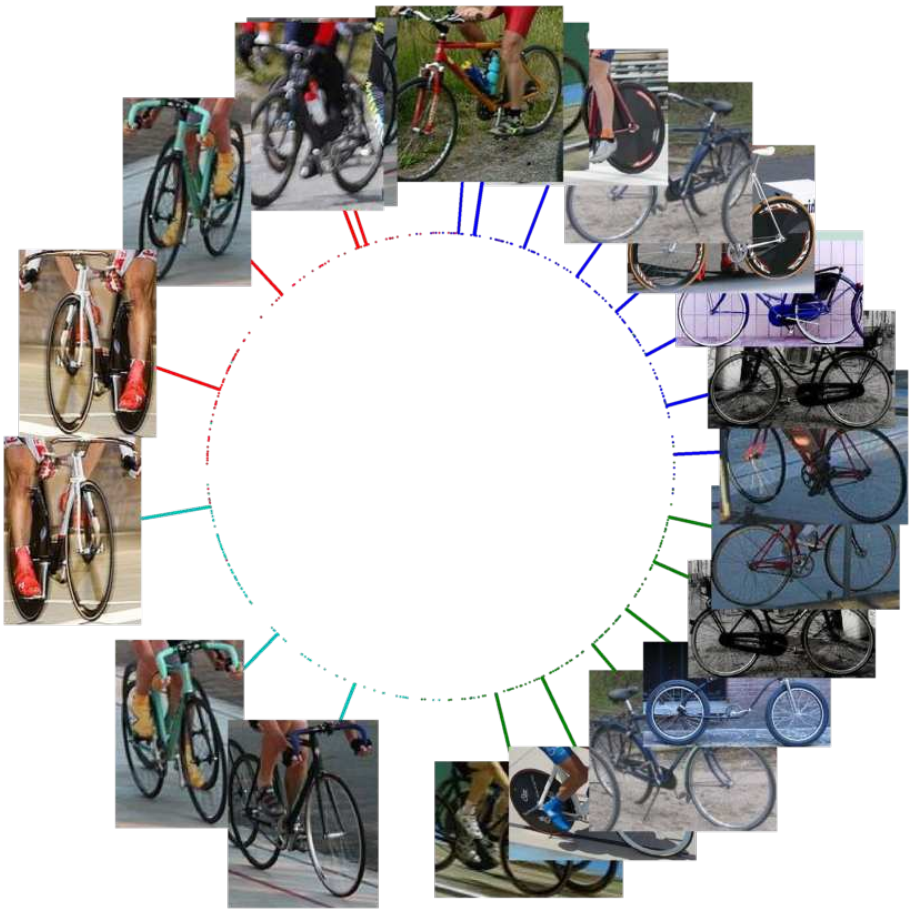

Figure 2: Visualization of $(2, K^{E}_{\mathrm{MMI}})$-Spectral Projection of the bicycle class.

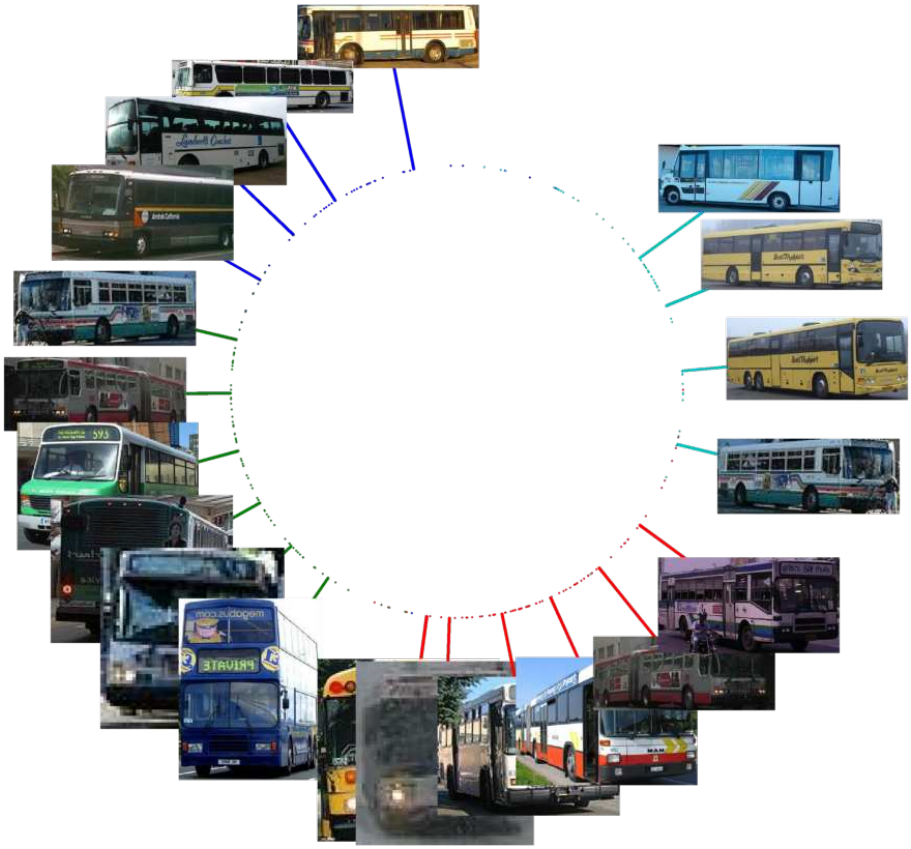

Figure 3: Visualization of $(2, K^E_{\text{MMI}})$-Spectral Projection of the bus class.

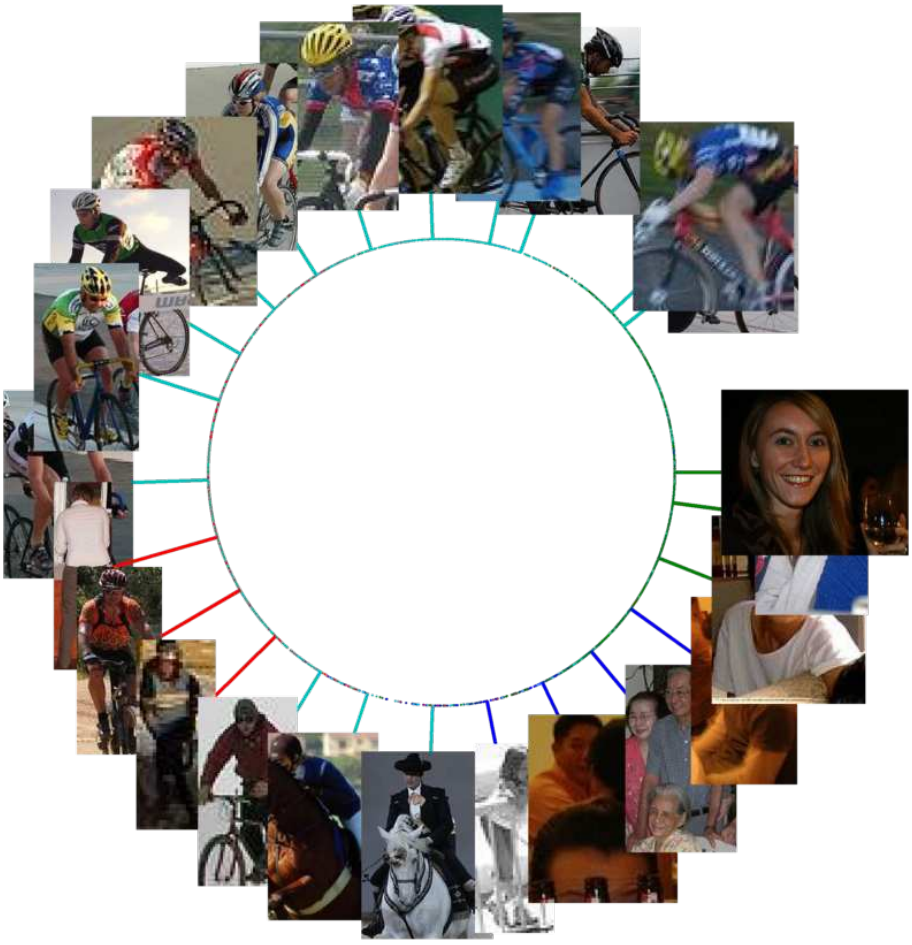

Figure 4: Visualization of $(2, K^{E}_{\mathrm{MMI}})$-Spectral Projection of the person class.

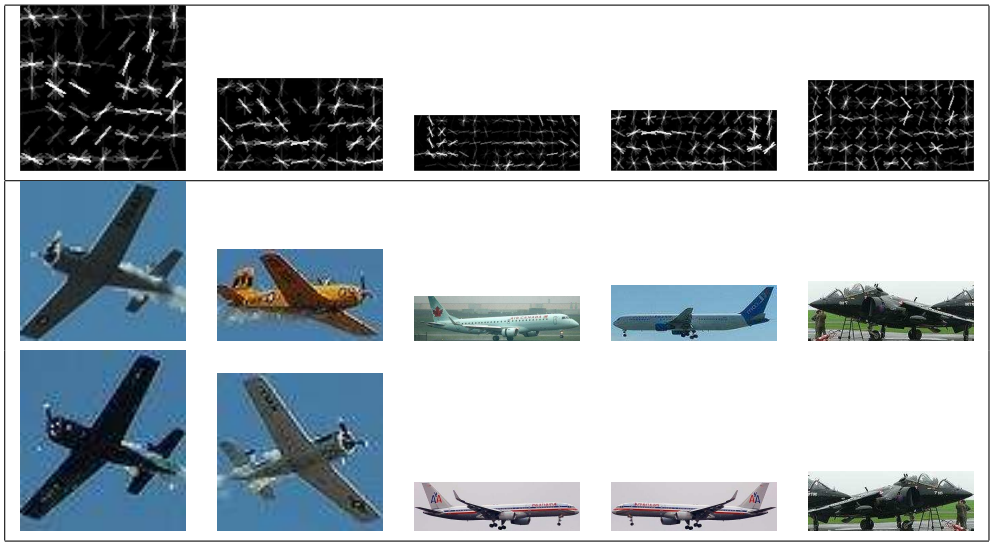

Figure 5: Filters learnt for aeroplane class in the MCL step with 5 components (first row). Below each component, the top two images associated with the component are depicted.

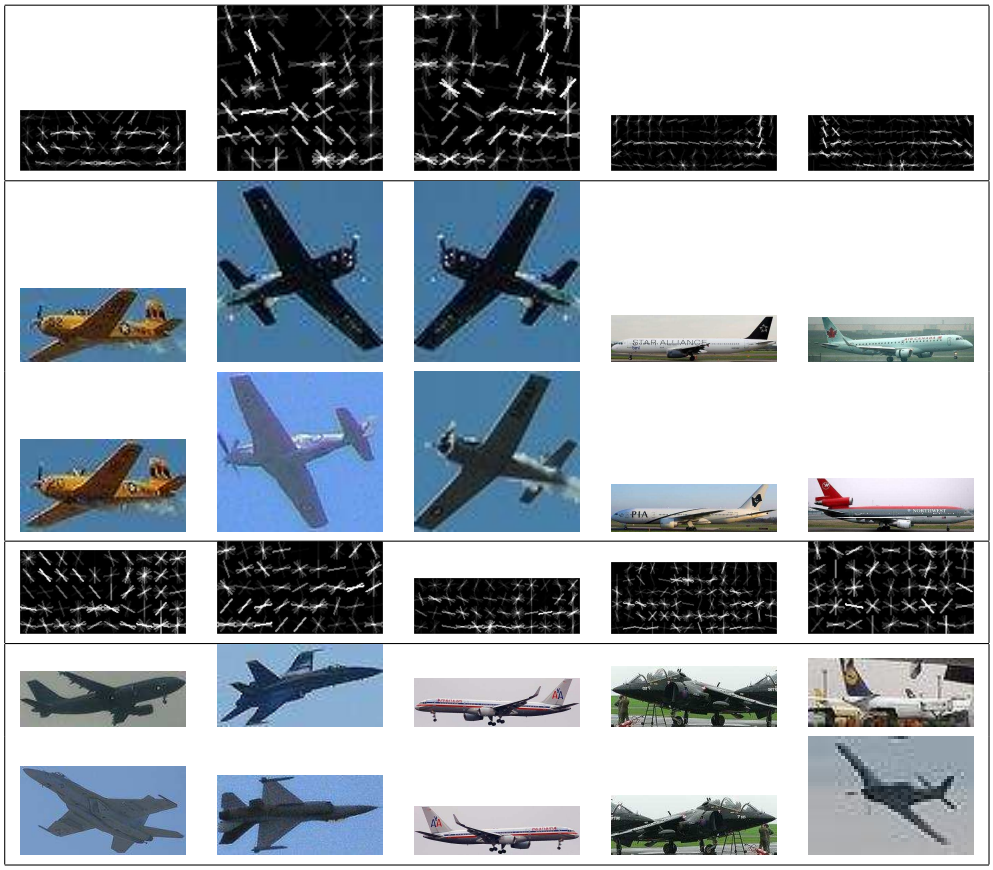

Figure 6: Filters learnt for aeroplane class in the MCL step with 10 components (first and fourth rows). Below each component, the top two images associated with the component are depicted.

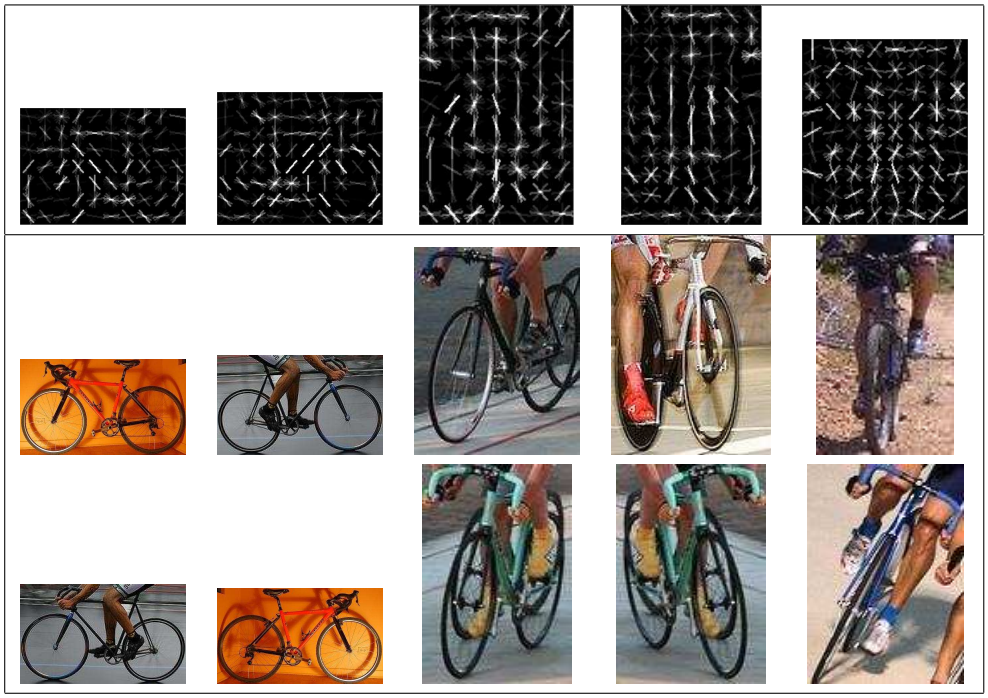

Figure 7: Filters learnt for bicycle class in the MCL step with 5 components (first row). Below each component, the top two images associated with the component are depicted.

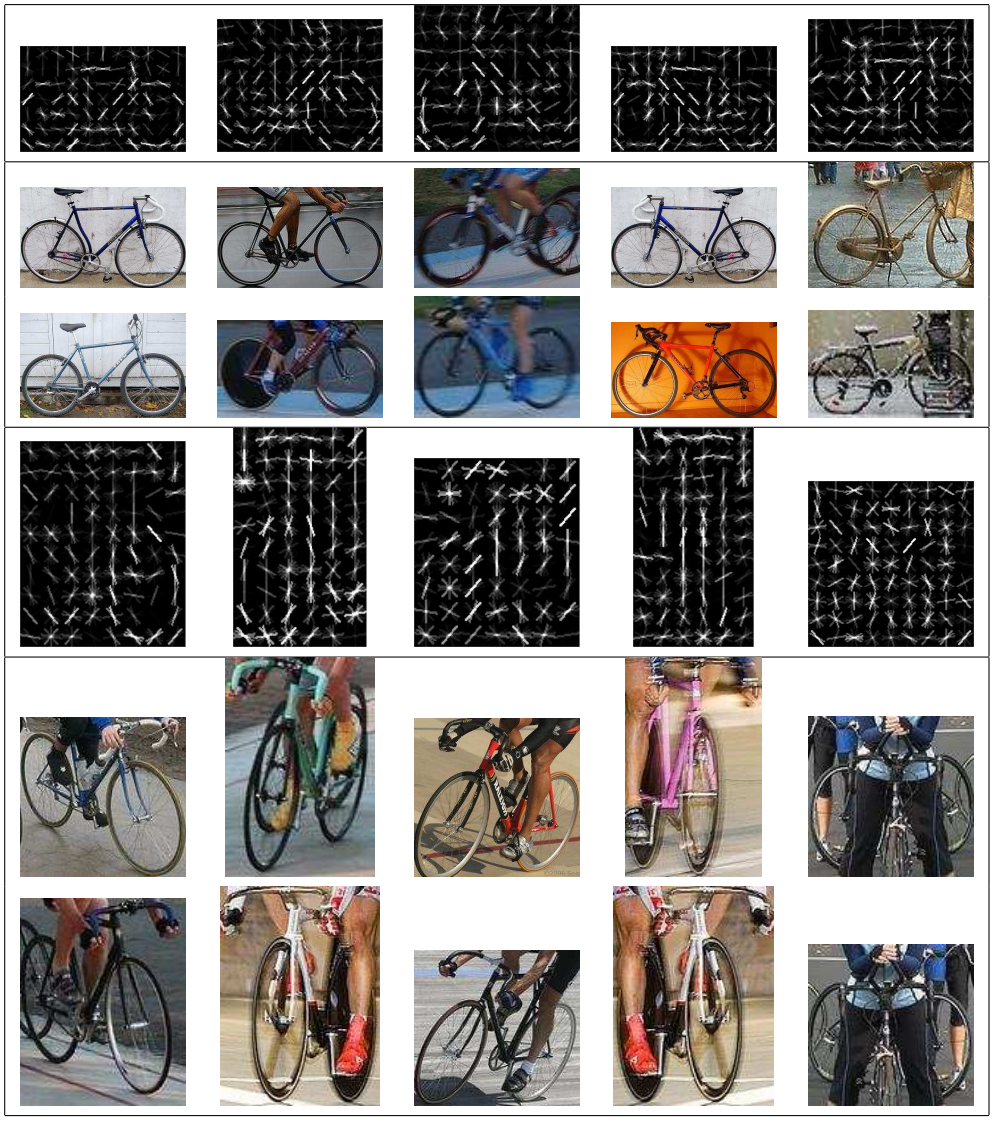

Figure 8: Filters learnt for bicycle class in the MCL step with 10 components (first and fourth rows). Below each component, the top two images associated with the component are depicted.

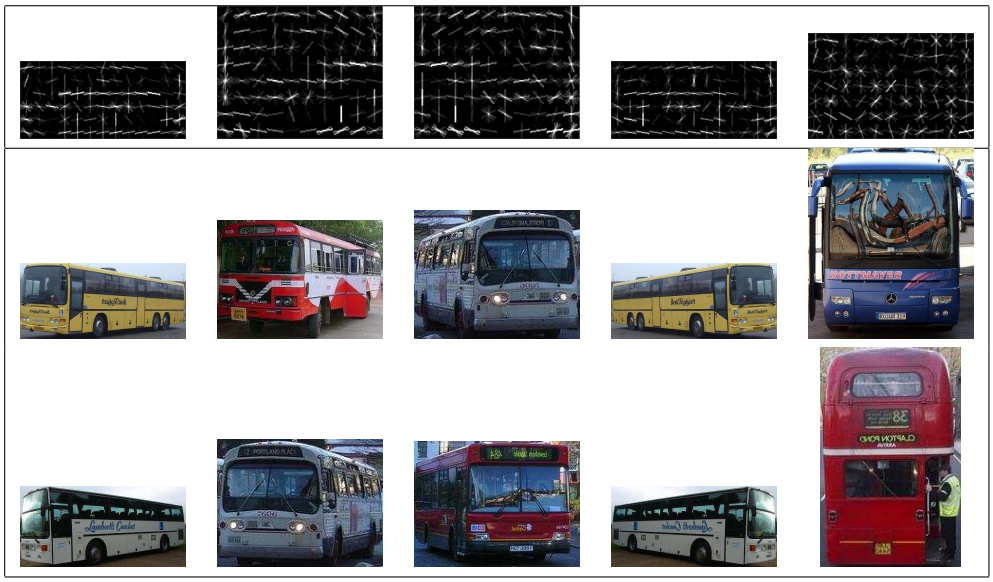

Figure 9: Filters learnt for bus class in the MCL step with 5 components (first row). Below each component, the top two images associated with the component are depicted.

Figure 10: Filters learnt for bus class in the MCL step with 10 components (first and fourth rows). Below each component, the top two images associated with the component are depicted.

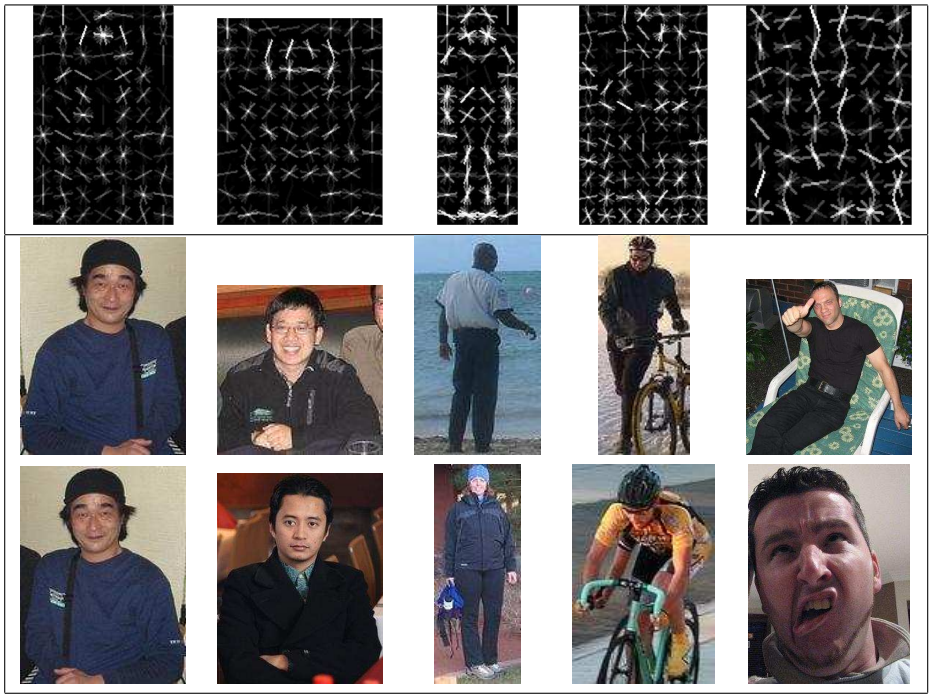

Figure 11: Filters learnt for person class in the MCL step with 5 components (first row). Below each component, the top two images associated with the component are depicted.

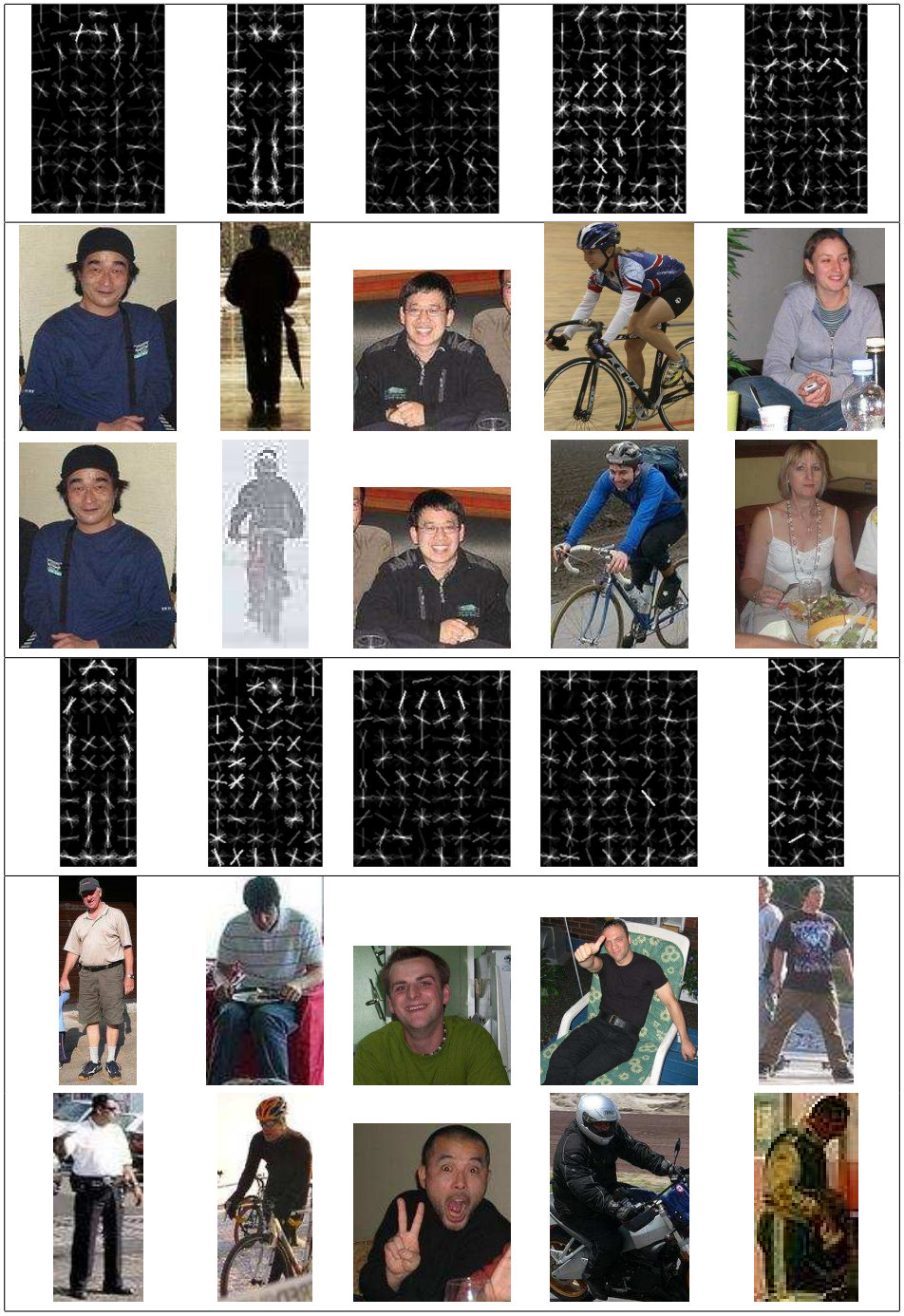

Figure 12: Filters learnt for person class in the MCL step with 10 components (first and fourth rows). Below each component, the top two images associated with the component are depicted.