



Figure 1: Left: The neural signals corresponding to the middle patch (top) and the patch below it (bottom) plotted as a function of time. The activities are given for the top-most data sample. Right: The segmentation result obtained from NMF analysis of the signals. First column from the left is the data, second column is the reconstruction from the feature activities, third and fourth columns are segmented objects.

## Oscillatory neural networks

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In [1] we have studied the emergent properties of an artificial neural network which combines segmentation by oscillations and biased competition for perceptual processing. The aim was to progress in image segmentation by mimicking abstractly the way how the cerebral cortex works. In our model, the neurons associated with features belonging to an object start to oscillate synchronously, while competing objects oscillate with an opposing phase.

The overall structure of our network is such that there are so called areas that correspond to patches in the image. The areas get bottom-up input from the pixels. The areas should be connected to each other with local interactions only, that is, there is no hierarchy or global signals. The different areas should work in the same way, using the same algorithms. The emergent properties of the network are confirmed by experiments with artificial image data as seen in Figure 1.

## References

- [1] T. Raiko and H. Valpola. Chapter 7: Oscillatory Neural Network for Image Segmentation with Biased Competition for Attention. In *From Brains to Systems: Brain-Inspired Cognitive Systems 2010*, Advances in Experimental Medicine and Biology, volume 718, pages 75–86, Springer New York, 2011.