Crabsort

Spike-sorting for small circuit networks

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Spike-sorting primer

Spike-sorting is the process of mapping action potentials to the originating cell.

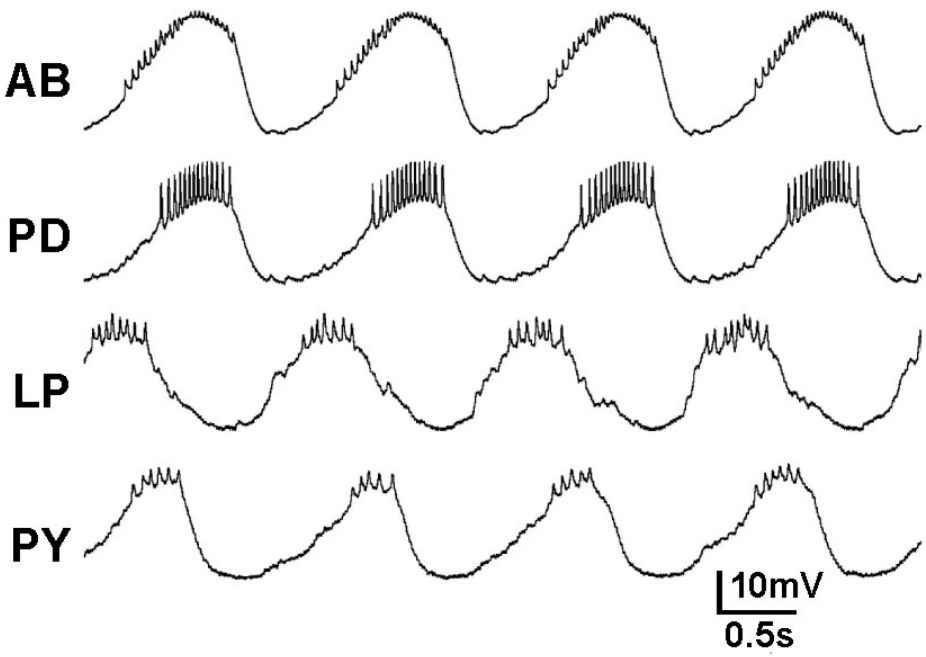

Figure: Intracellular recordings of pyloric cells.

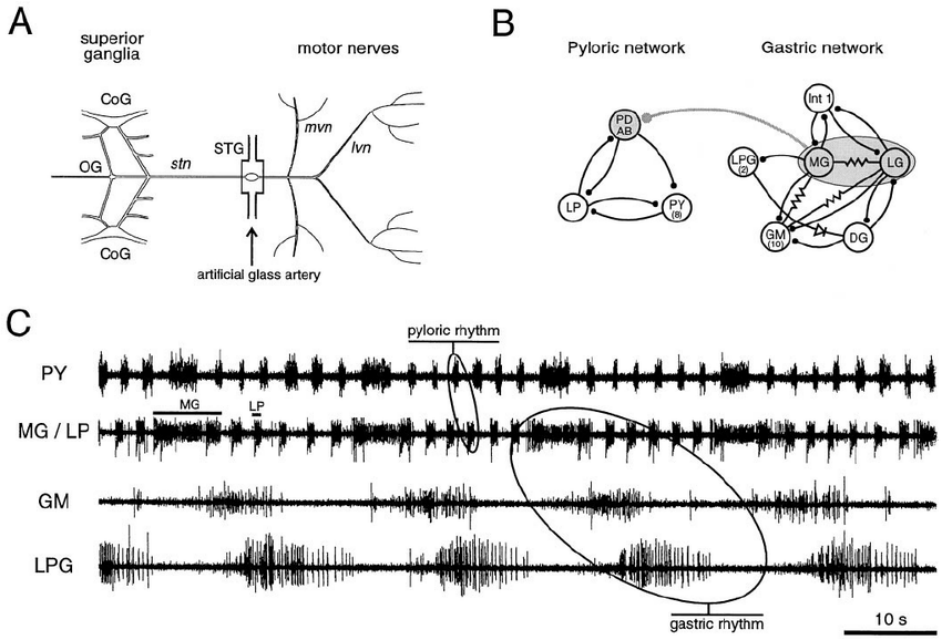

Figure: **A** circuit diagram of nerves; **B** connectivity diagram, circles are cells, synapses are lines and dots; **C** extracellular recording of motor nerves.

How to sort spikes

1. Identify spikes from membrane potential waveform (easy)
2. Sort spikes using some magic algorithm (hard)

For large networks, spike sorting means:

1. Methods: PCA, SVD, stochastic k-means matching of correllograms
2. Data: 100s of channels but without a ground truth

For small networks, spike sorting means:

1. Methods: dimensionality reduction, machine learning
2. Data: few channels with known activity

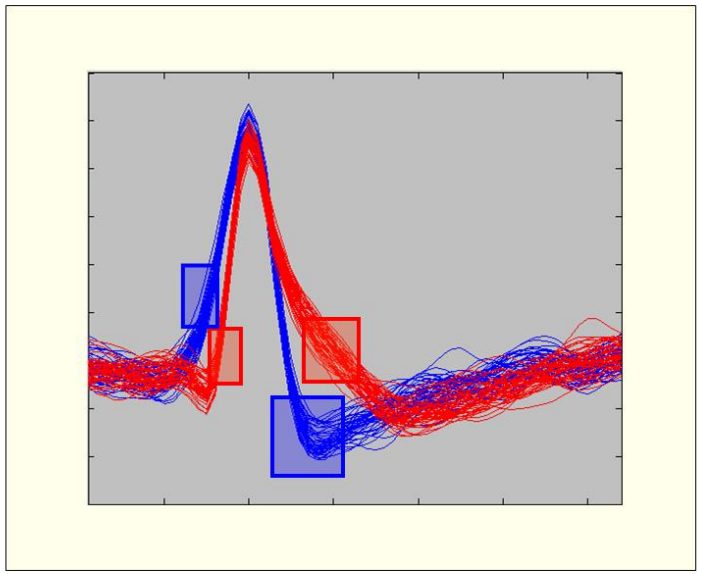

Figure: Spike-sorting using PCA and window filtering by spike-waveform analysis (R. Quian Quiroga).

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Dimensionality Reduction

Dimensionality reduction is the process of taking high-dimensional data and representing it in a lower dimensional space.

Crabsort allows the user to:

1. Dimensionally reduce the data to a 2-dimensional manifold
2. Interactively label the data

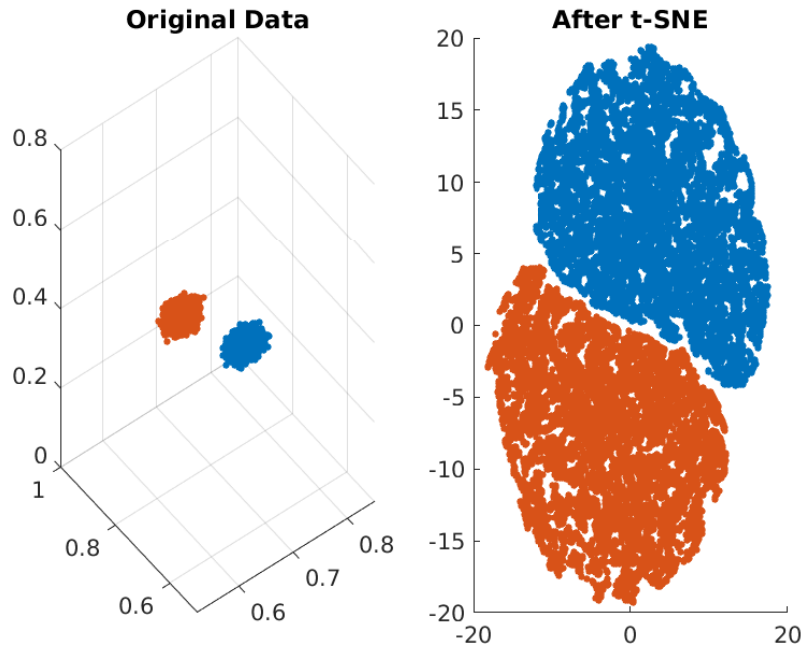

Figure: Using the t-SNE algorithm to reduce a 3-dimensional dataset to a 2-dimensional dataset.

t-SNE

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