

Electrophysiological diversity of head direction neurons revealed by t-SNE multidimensional embedding

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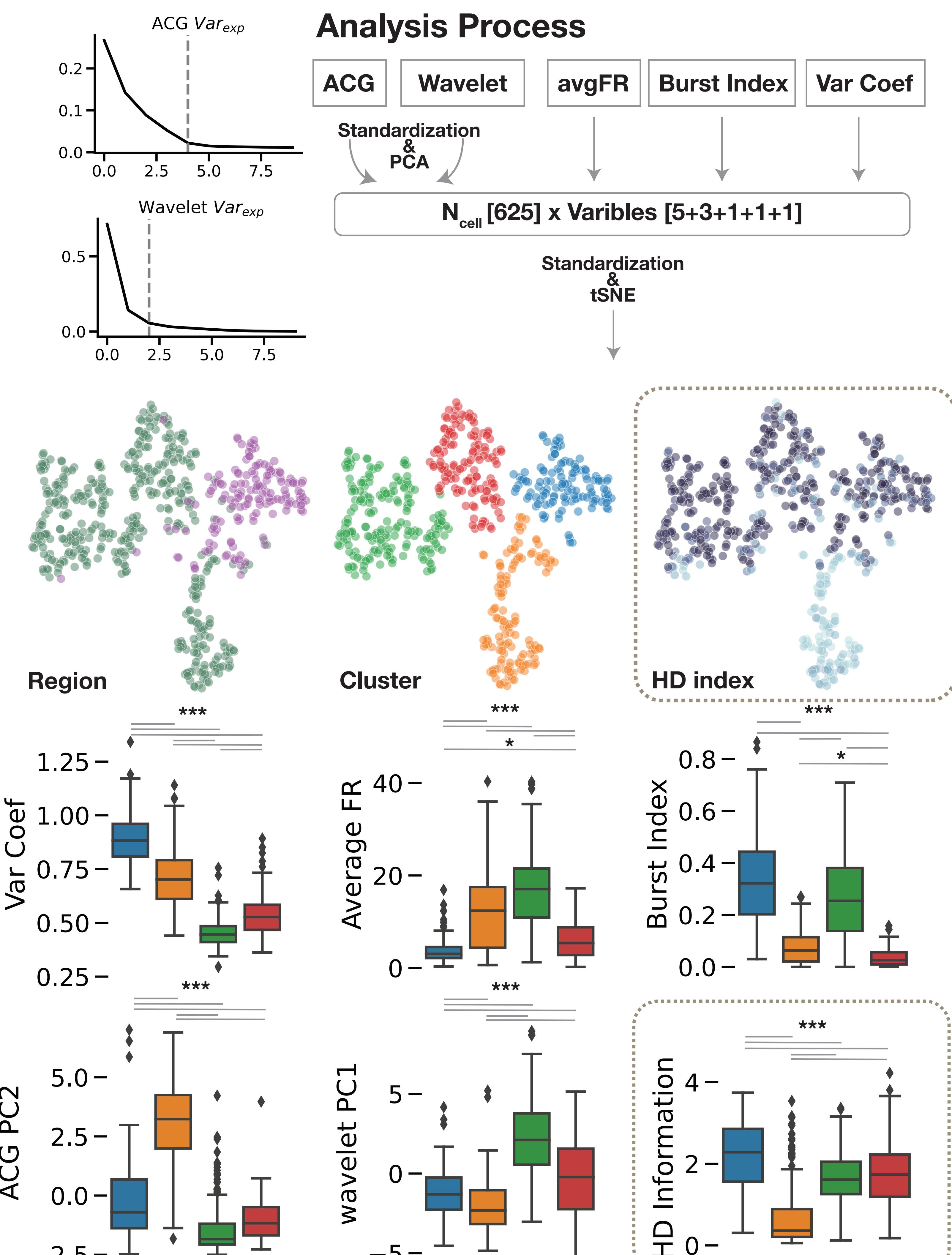
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Introduction

- The head direction (HD) cells function as an '**internal compass**' for spatial navigation by encoding head direction information and transmitting it to the para-hippocampal region. [1,2]
- Most studies so far have considered the thalamic HD cells to be an **electrophysiologically homogeneous** population. [3]
- However, a systematic analysis of potential HD cell variability is presently lacking.

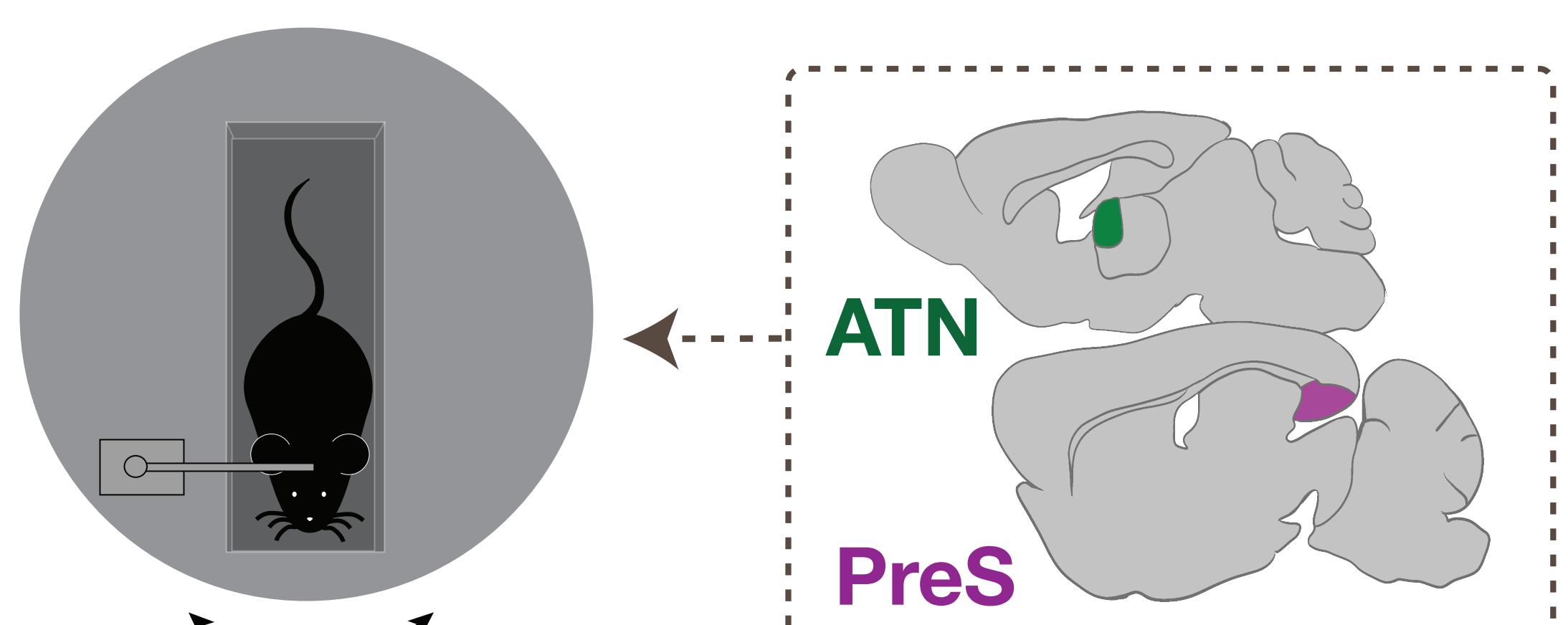
Clustering on Physiological Variables



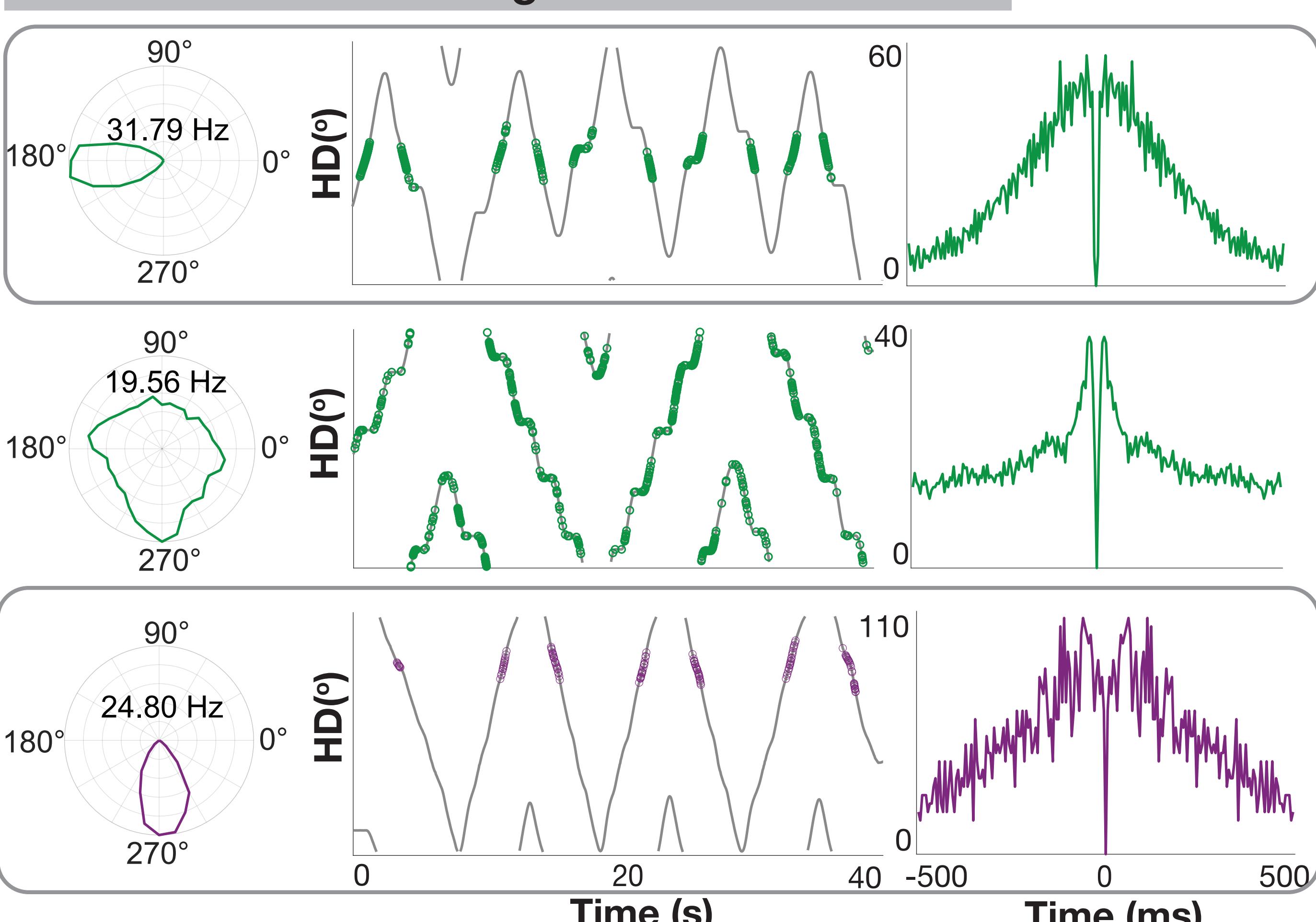
Take home message:

By using basic electrophysiological features, we identified discrete HD and non-HD neuron subgroups.
tSNE revealed two separate clusters in thalamic HD cells which differ in variance coefficient, average firing rate, and burst index.

Experiment Protocol & Data

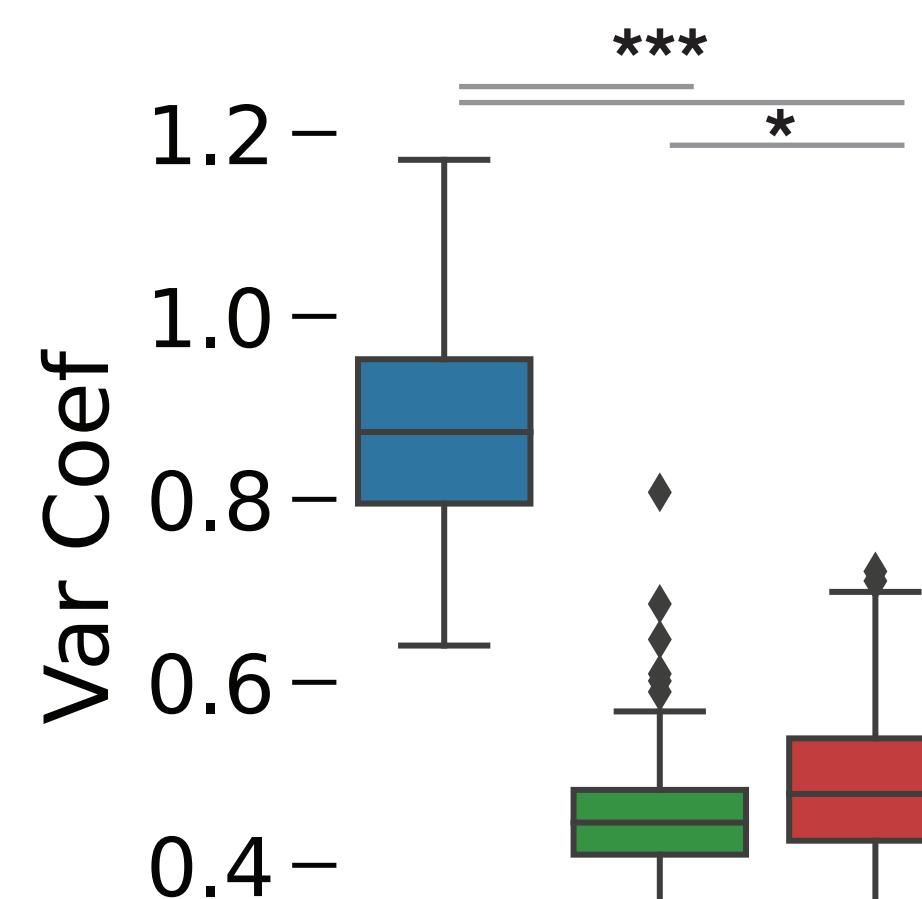
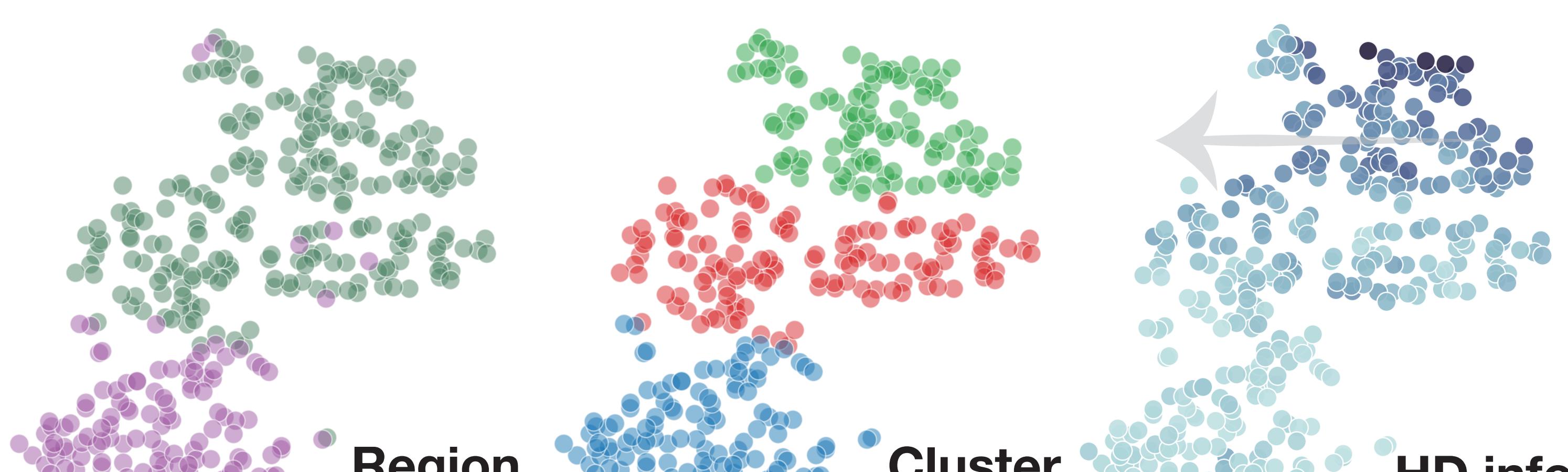
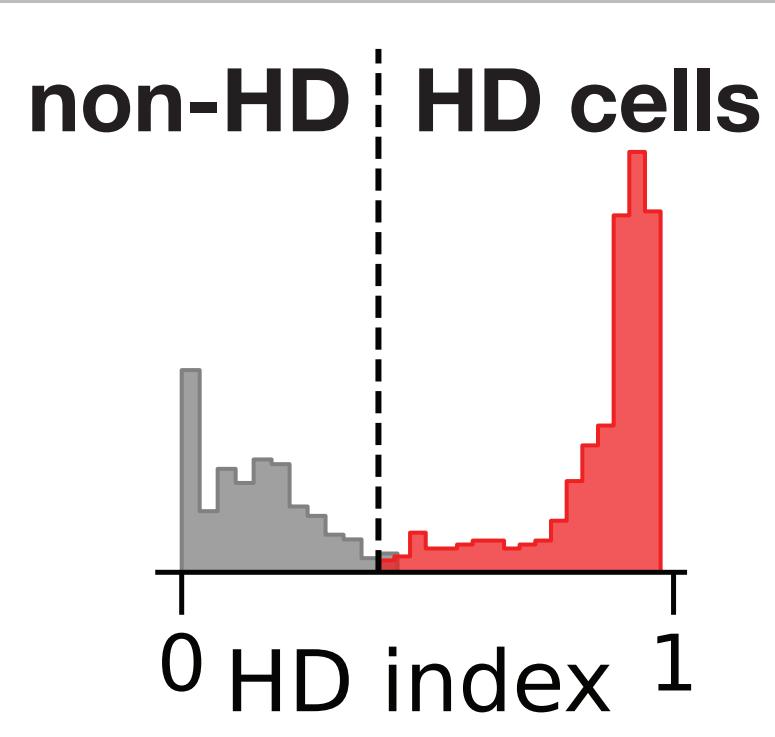


Juxtacellular Recording of nonHD & HD cells



HD Cells Clustering

Identify HD cells



Take home Message

- Differentiation of hd and nonHd cells in thalamus and presubiculum based upon firing properties.
- t-SNE embedding of HD cells uncovers **two gradients** which can be explained by **average firing rate** and **head direction information**.

Reference:

[1] Taube 1998

[2] Taube 2007

[3] Viejo and Peyrache 2020

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