Introduction to Neural Codes

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Place cells and receptive fields

Definitions

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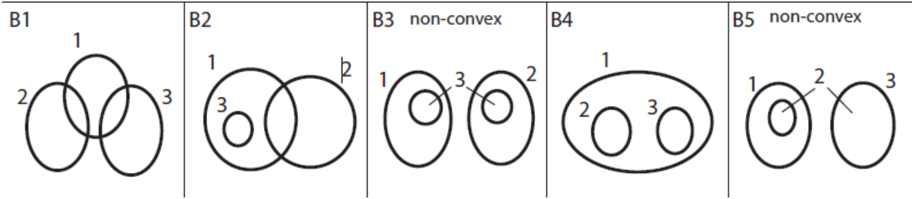

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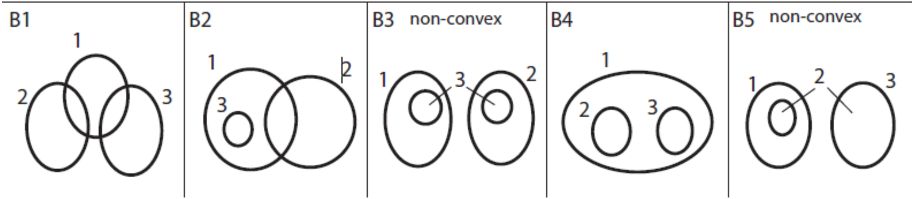

The big question

Which codes can be idealized as receptive fields?

Neural Codes

Definition

Given neurons labelled $\{1, ..., n\} = [n]$, define a *neural code* $\mathcal{C}$, to be a collection of binary words $c = (c_1, ...c_n)$. For any $\mathcal{C}$ and any $c \in \mathcal{C}$, define $\text{supp}(c) \stackrel{def}{=} \{i \in \{1, ..., n\} \mid c_i = 1\}$ and, $\text{supp}(\mathcal{C}) \stackrel{def}{=} \{\text{supp}(c) \mid c \in \mathcal{C}\}$.

Example

Let $\mathcal{C} = \{000, 010, 110, 001\}$. Then $\text{supp}(\mathcal{C}) = \{\emptyset, \{2\}, \{1, 2\}, \{3\}\}$

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simplicial complex $\Delta(\mathcal{C}) \overset{def}{=} \{\sigma \subseteq \text{supp(c)} \mid \sigma \subseteq c \text{ for some } c \in \mathcal{C}\}$

Example

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