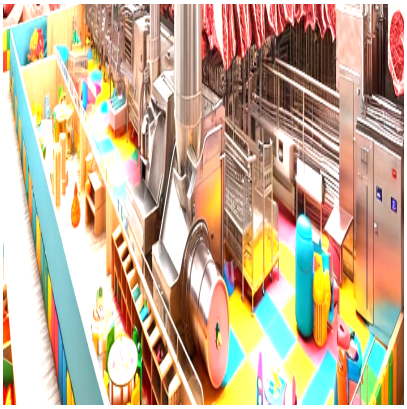

Urban inhibition

Description

A group of students meets casually to relax and chat. One of the lecturers enters the circle. The conversation becomes stilted. Silence descends. The presence of any particular individual can excite conversation â?? or inhibit it.

There are complicated dynamics in play here involving power, familiarity, social norms, and relationships within groups. That one agent might excite or inhibit the conversation of others by inducing silence or changing the subject, is a demonstration of some very ordinary but subtle group dynamics. Itâ??s also a feature of neural networks.

> In some cases, there are sets of units that are mutually *inhibitory* so that only one can be active at a time but any of which could be combined with most other units [33].

I italicised *inhibitory* as a key focus of attention in that line from an early technical paper by David Rumelhart et al explaining the mechanism in neural networks for capturing the fluid nature of human categories (schemas).

Whatâ??s in the room?

As I explored in other posts, in their early example of parallel distributed processing (i.e. neural networks) they train an associative neural network on the contents of large numbers of rooms. Thereâ??s no marker in the training data indicating the category of room, or its name, e.g. kitchen, bedroom, lounge, etc. But itâ??s clear from the performance of the model after training that fridge, sink and stove go together; bed, wardrobe and lamp constitutes another set of compatible co-occurring items.

In reconstructing likely combinations of items the neural network will optimise its outputs to favour likely combinations (considering its training data). In practical terms we could say that certain items **excite** or **inhibit** other items.

If you say you want a room with a stove, it is unlikely you will opt for a bed in the same space. Stoves *inhibit* beds. On the other hand, beds *excite* bed lamps; stoves *excite* sinks, etc. That said, we can think of situations where we know we have a bed and a stove in the same space, â?? what else are we likely to have there? Perhaps a sink (as in a bedsit), but not likely a bathtub.

Forced combinations (bed and stove) generate excitations and inhibitions by virtue of dynamic sets of complex relations and interrelations between items codified in the neural network weights and biases established during training, even for combinations of items not encountered during training.

Inhibiting groups

During simulation, a node that is excitatory for one set of inputs may serve as inhibitory for a different set of inputs. The inhibitory effect may be more obvious in the case of an associative neural network (ANN) of the kind Iâ??ve been describing.

If an ANN is designed to associate buildings in an urban neighbourhood, trained with lots of examples of building combinations, then itâ??s likely that during simulation, the presence of say a meat processing plant will inhibit the presence of say a child minding centre. If a child minding centre is â??clampedâ?• as definitely present, then its more likely that a cafe or park get â??excited.â?• Various combinations of buildings will produce different complex patterns of excitation and inhibition.

Unlikely combinations

We can â??forceâ?• a network to conceptualise unlikely combinations, such as a nightclub adjacent to a graveyard. At some layer in the ANN, activations at the level of features will produce patterns resulting in the activation-inhibition of other buildings for the neighbourhood. Eg a transport hub is ok, but an amusement park is less likely.

AANs involve an optimising process through relaxation during simulation (prediction). Thatâ??s different to LLMs, which have a lighter workload on the simulation side, where the prediction (next word) is a token with (softmax) probabilities. Both AANs and LLMs optimise (or resolve) patterns of excitation and inhibition in the course of their predictions, though by different means.

We could speak of the compatibility of certain urban elements. Zoning laws typically take account of this. The capability of one element or group of elements in the urban landscape to inhibit others, singularly or in combination, provides a further metaphor of urban processes.

Following Latour, this urban metaphor shows how an urban element might â??authorize, allow, afford, encourage, permit, suggest, influence, block, render possible, forbidâ?• [72] another.

References

- Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-network-theory* Oxford: Oxford University Press.
- Rumelhart, D. E., P. Smolensky, et al. (1986). Schemata and sequential thought processes in PDP models. *Parallel Distributed Processing: Explorations in the Microstructure of Cognition,*

Volume 2, Psychological and Biological Models. J. L. McClelland and D. E. Rumelhart. Cambridge, MA: MIT Press**:** pp. 7-57.

Note

- Featured image is from Dall-e, prompted by â??Please generate a close up image showing a child minding centre incorporated into a meat processing plant. Donâ??t show any human or animal forms.â?•

Category

1. Artificial Intelligence

Tags

1. excitation
2. inhibition
3. optimization

Date Created
January 13, 2024
Author
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