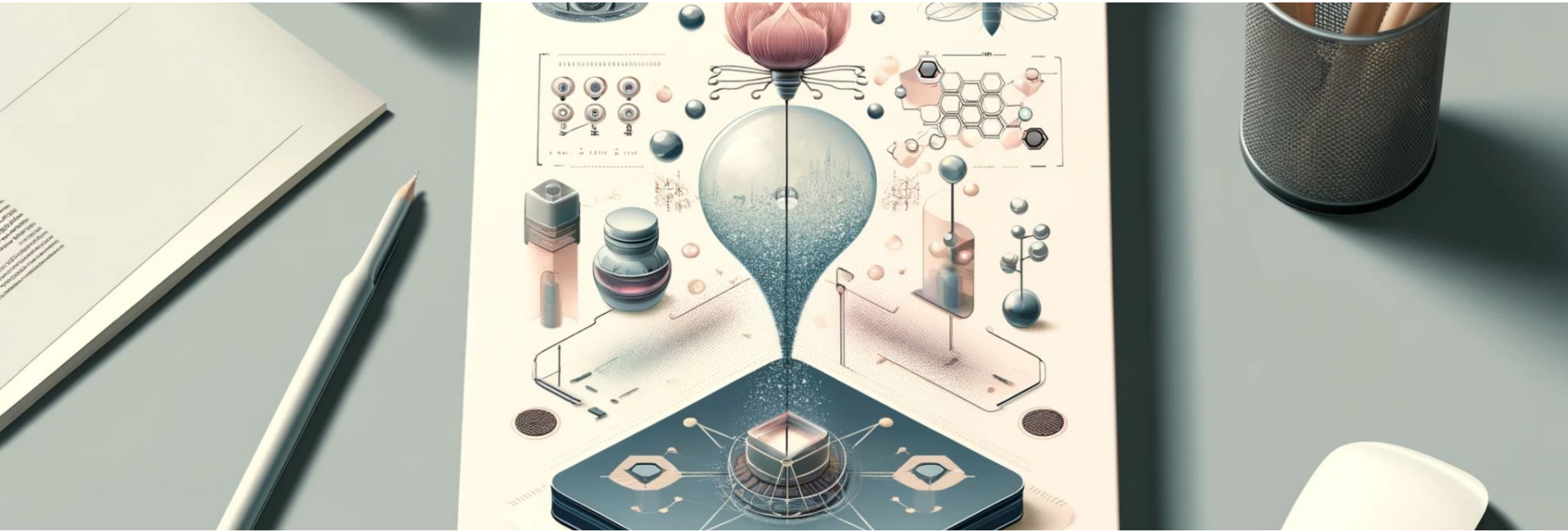
CSE7850/CX4803 Machine Learning in Computational Biology



Lecture 23: ML for Network Biology

Yunan Luo

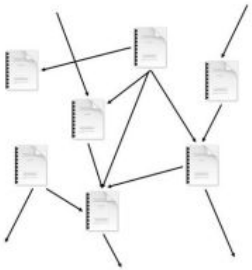
Networks (graphs)

Image credit: Medium

Social networks

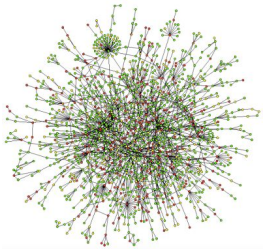
Image credit: Missoula Current News

Internet

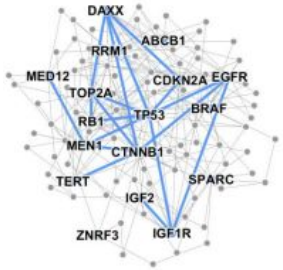


Citation networks

Underground networks



Protein-protein interaction networks



Disease pathways

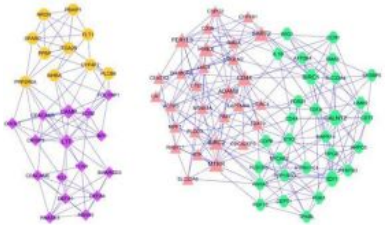


Image credit: ese.wustl.edu

Gene regulatory networks

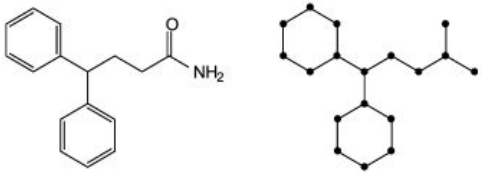


Image credit: MDPI

Molecules

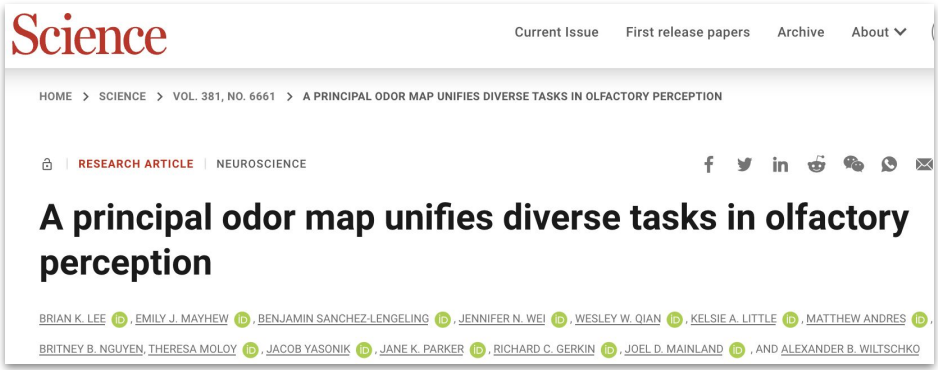
Today's papers

- Paper #1: Representation learning on protein networks

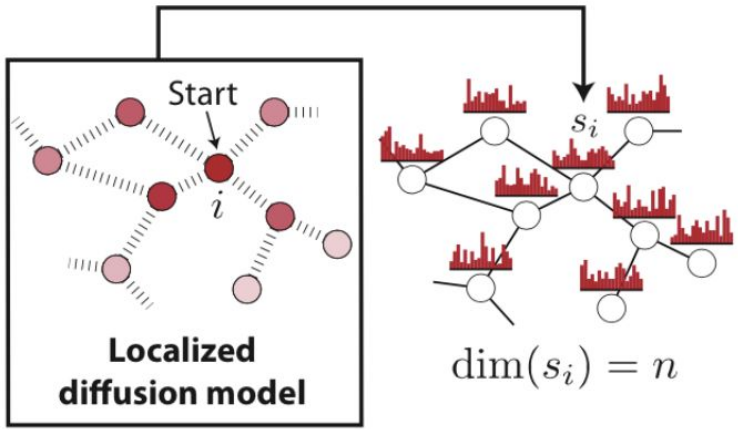
Contextualizing protein representations using deep learning on protein networks and single-cell data

Michelle M. Li[1], Yepeng Huang[1], Marissa Sumathipala[1], Man Qing Liang[1], Alberto Valdeolivas[2], Ashwin N. Ananthakrishnan[1,3], Katherine Liao[1,4], Daniel Marbach[2], and Marinka Zitnik[1,5,6,7‡]

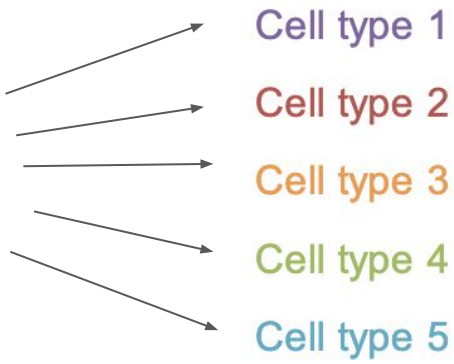
- Paper #2: Deciphering odors of molecules using graph ML



Paper #1: Representation learning on protein networks

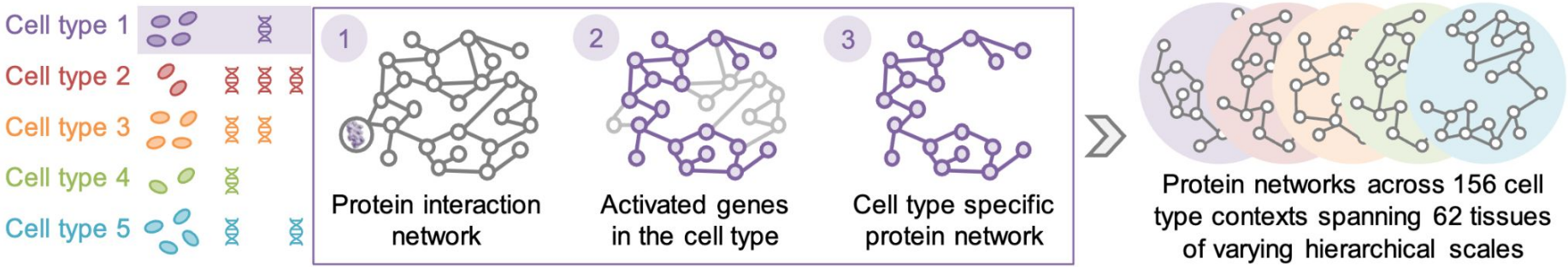


Learning representations on the global protein/gene network



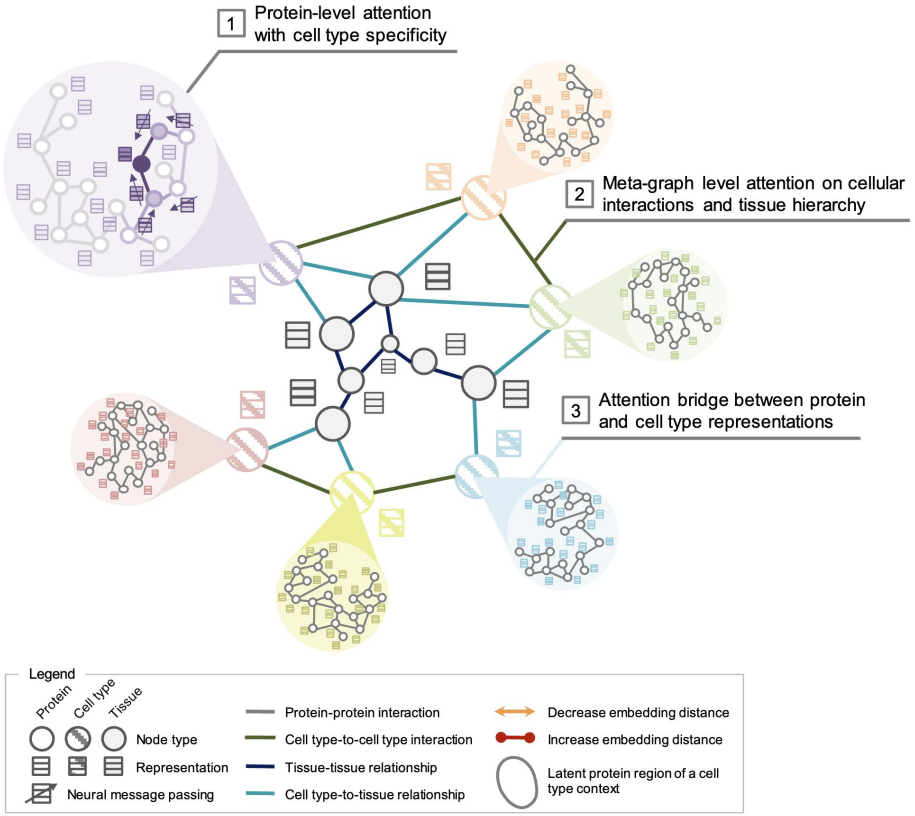
The representations are used to make predictions in different contexts, e.g., a cell type (defined by a group of expressed genes)

Paper #1: Representation learning on protein networks



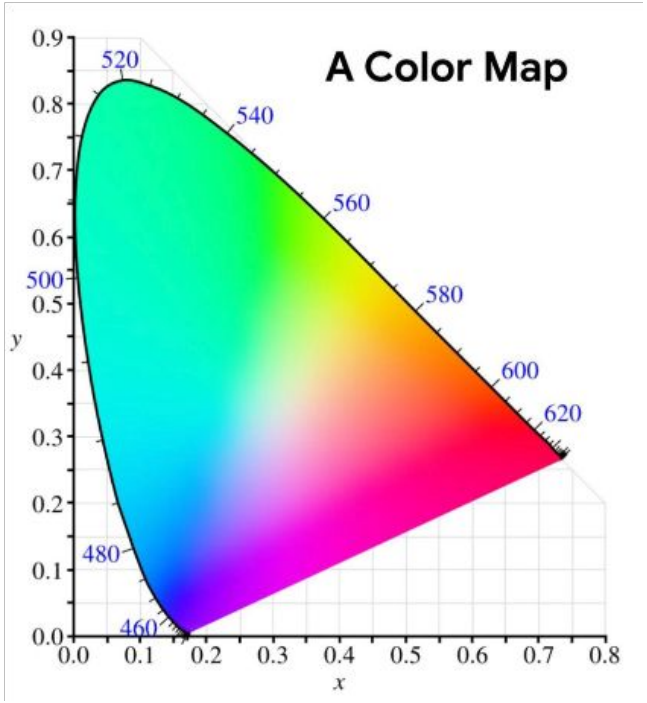
Extract subnetwork defined by each cell type and learn contextualized representations

Paper #1: Representation learning on protein networks



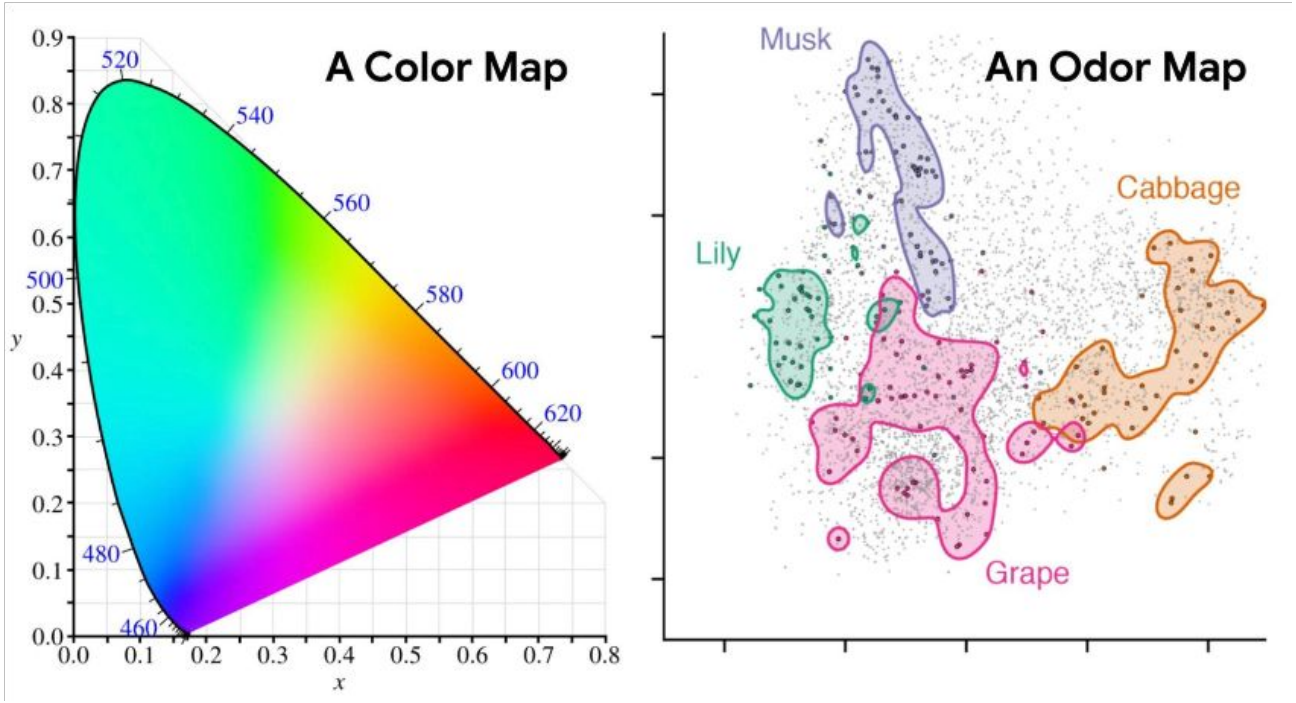
- How to learn node representations
- How to connect different contexts (cell types)

Paper #2: Digitizing and deciphering odors



- There are three color basis: R, G, B
- We can mix R,G,B to create other colors

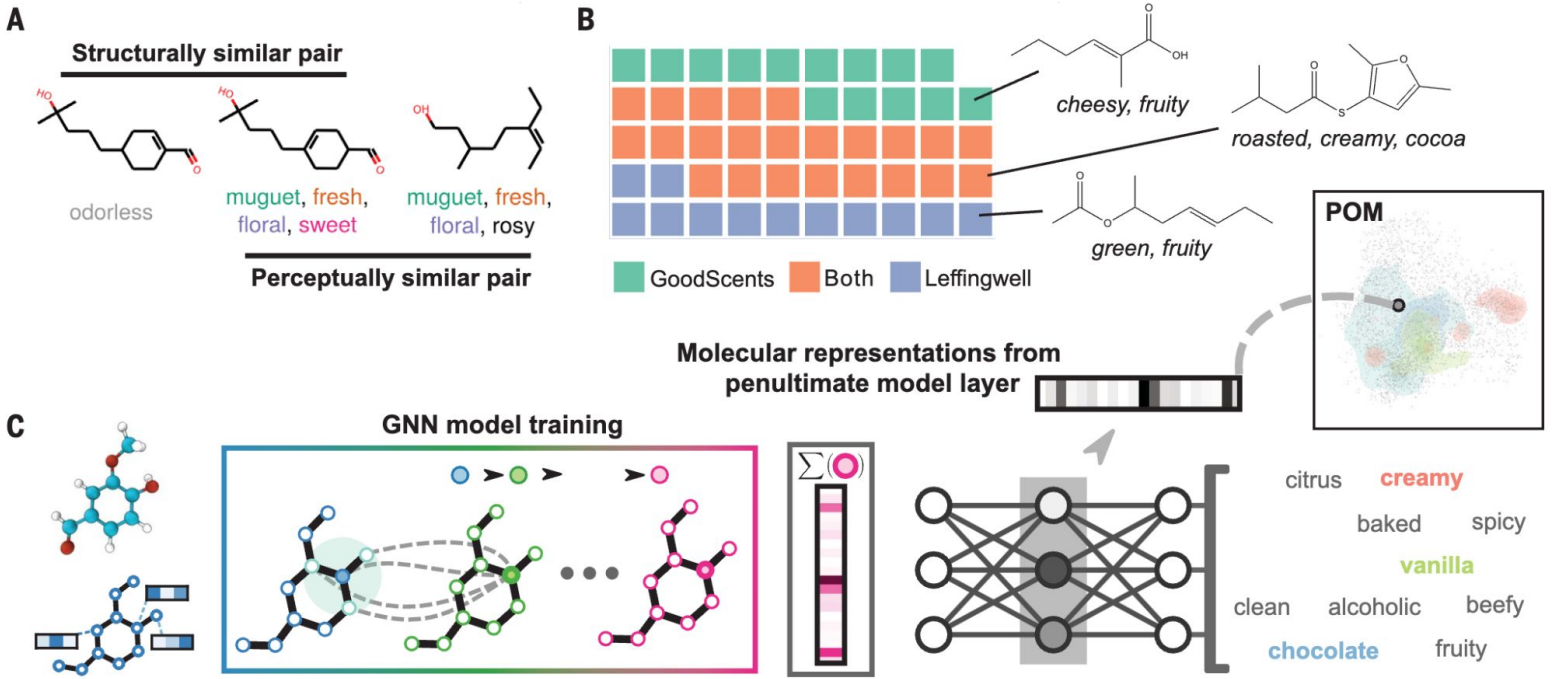
Paper #2: Digitizing and deciphering odors



- There are three color basis: R, G, B
- We can mix R,G,B to create other colors

- Do we have such basis in the smell (odor) space?
- If so, we could create new smells by mixing the basis

Paper #2: Digitizing and deciphering odors



Teleporting Scent

A sensor “analyzes” a given scent and decomposes it

A “scent print” at another place synthesizes the scent using the basis scents

https://www.osmo.ai/blog/teleporting-scent