UCSF Bakar Computational Health Sciences Institute

PMWC SILICON VALLEY JAN. 20-23 PRECISION MEDICINE WORLD CONFERENCE 2019

Biomedical Knowledge Networks at Point of Care

January 23, 2019

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Biomedical Informatics Doctoral Candidate

Sharat Israni, PhD

Executive Director & Chief Technology Officer

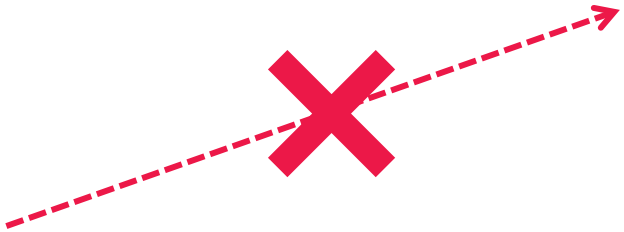
The Transformation From Data to Precision Medicine Has Not Kept at Pace

Transformation →

Patient Care

↑ Volume of data

↑ Types of data



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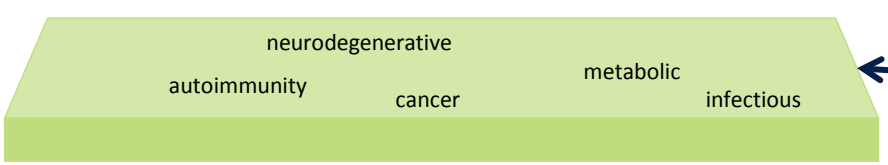
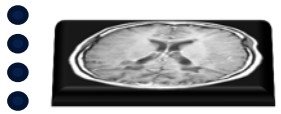
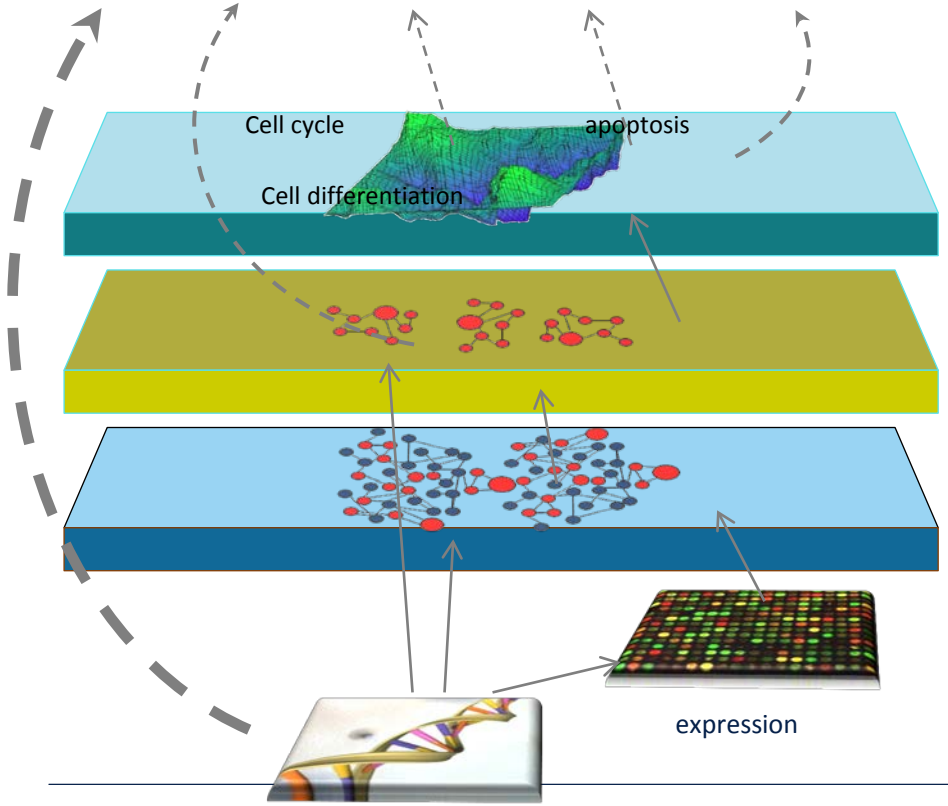
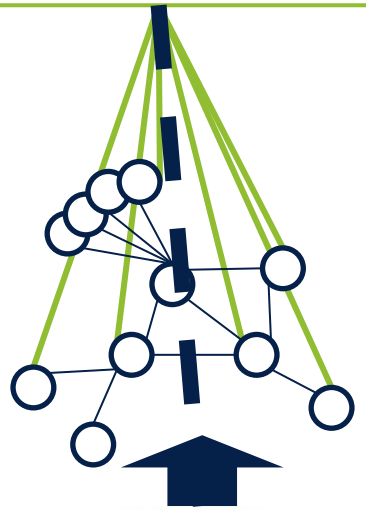
Hierarchical organization of biological complexity



Electronic Health Records







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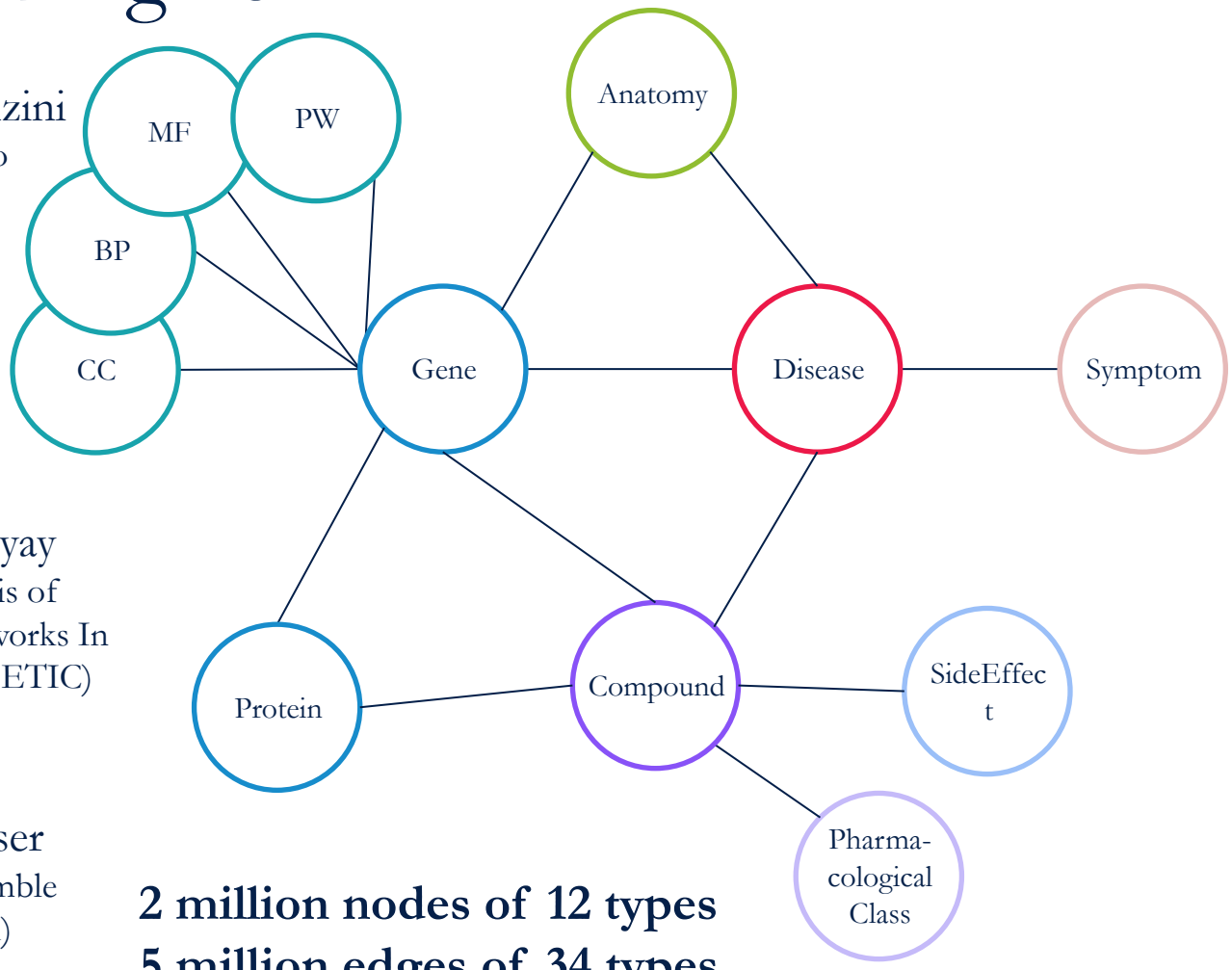
SPOKE - Scalable PrecisiOn Medicine Knowledge Engine

Sergio Baranzini
Project Rephetio

Sourav Bandyopadhyay
Modular Analysis of Genomic NETworks In Cancer (MAGNETIC)

Michael Keiser
Similarity Ensemble Approach (SEA)



2 million nodes of 12 types
5 million edges of 34 types

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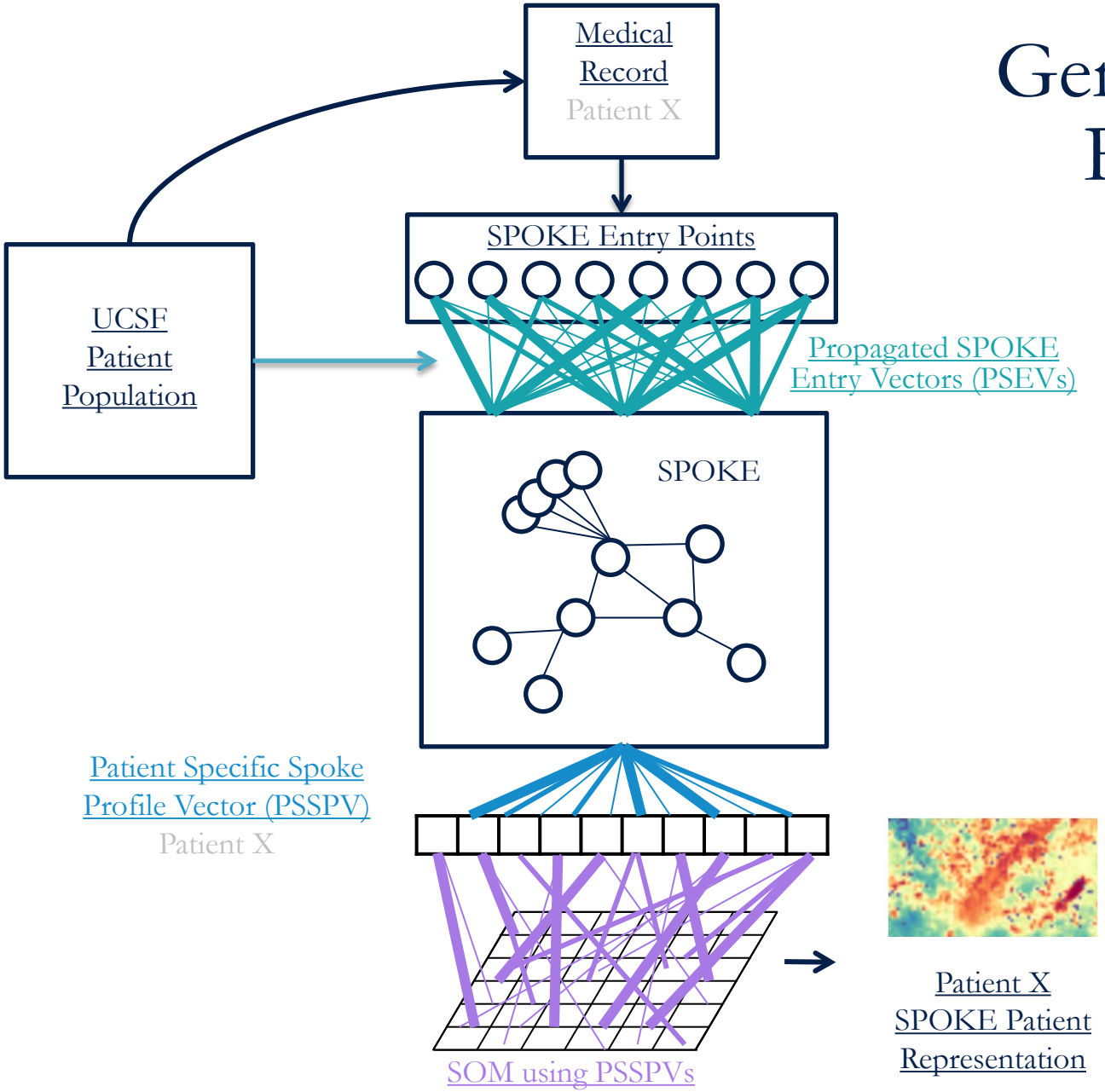
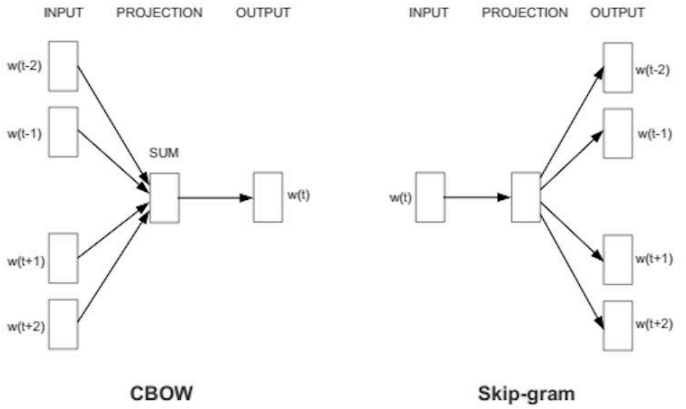
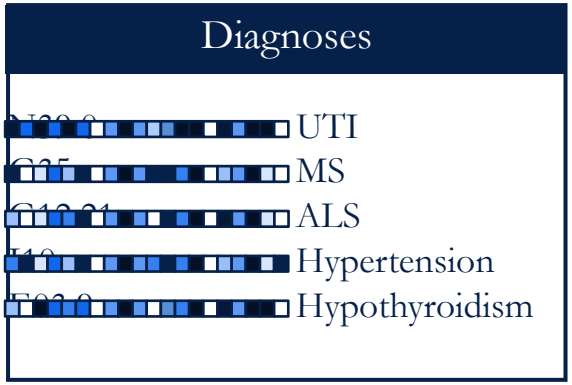
Generating Patient Representations Using SPOKE

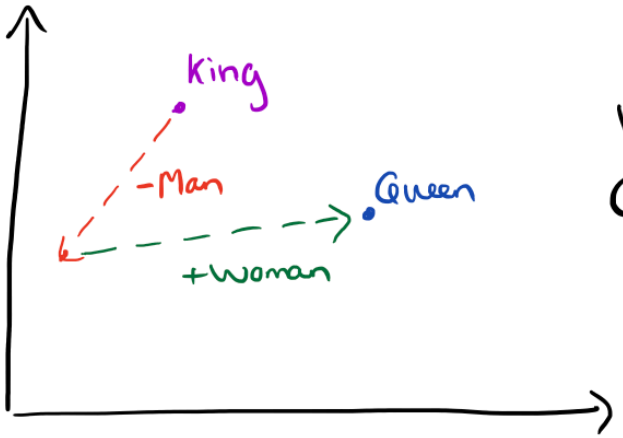


EHR Code Vectorization

- Machines are good with numbers
- Common practice to turn EHR entities into numbers or vectors
  - Word2Vec







Vector Composition

King – Man + Woman = Queen

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EHR Code Vectorization

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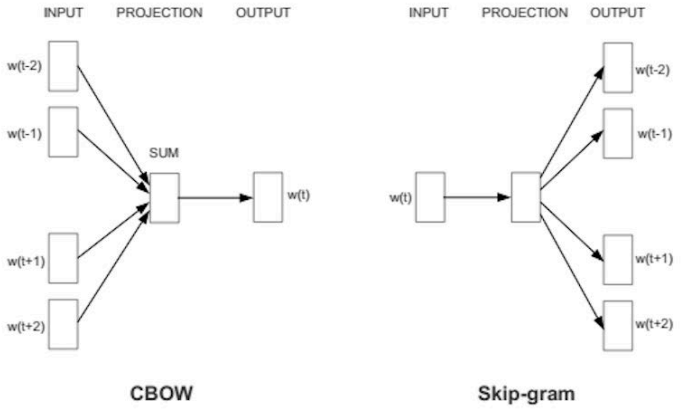
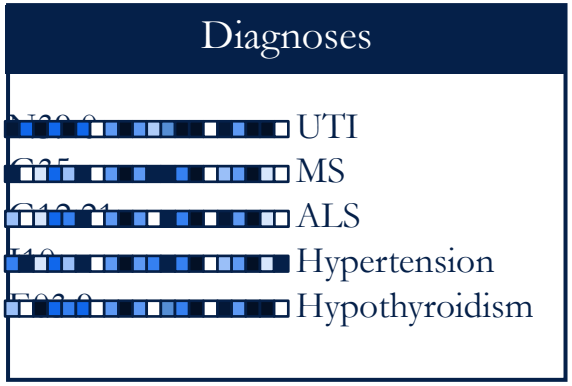
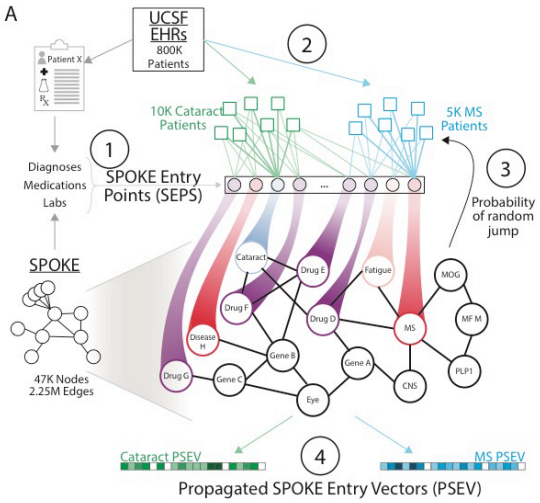
- My method:
  - Uses EHRs as context to determine level of information flow through each node in a knowledge network
  - Propagated SPOKE Entry Vectors (PSEVs)
- Main difference: one is a black box







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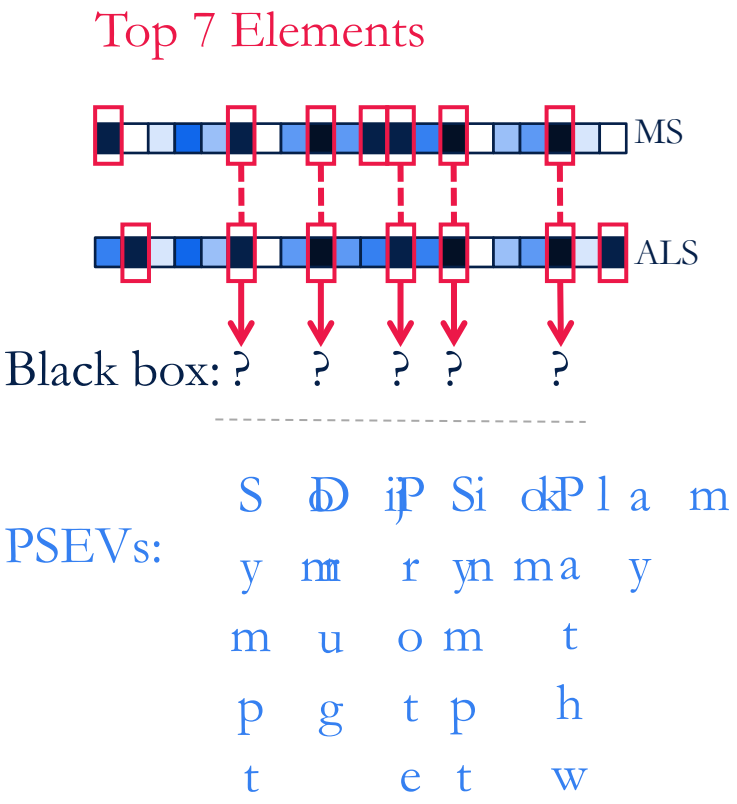
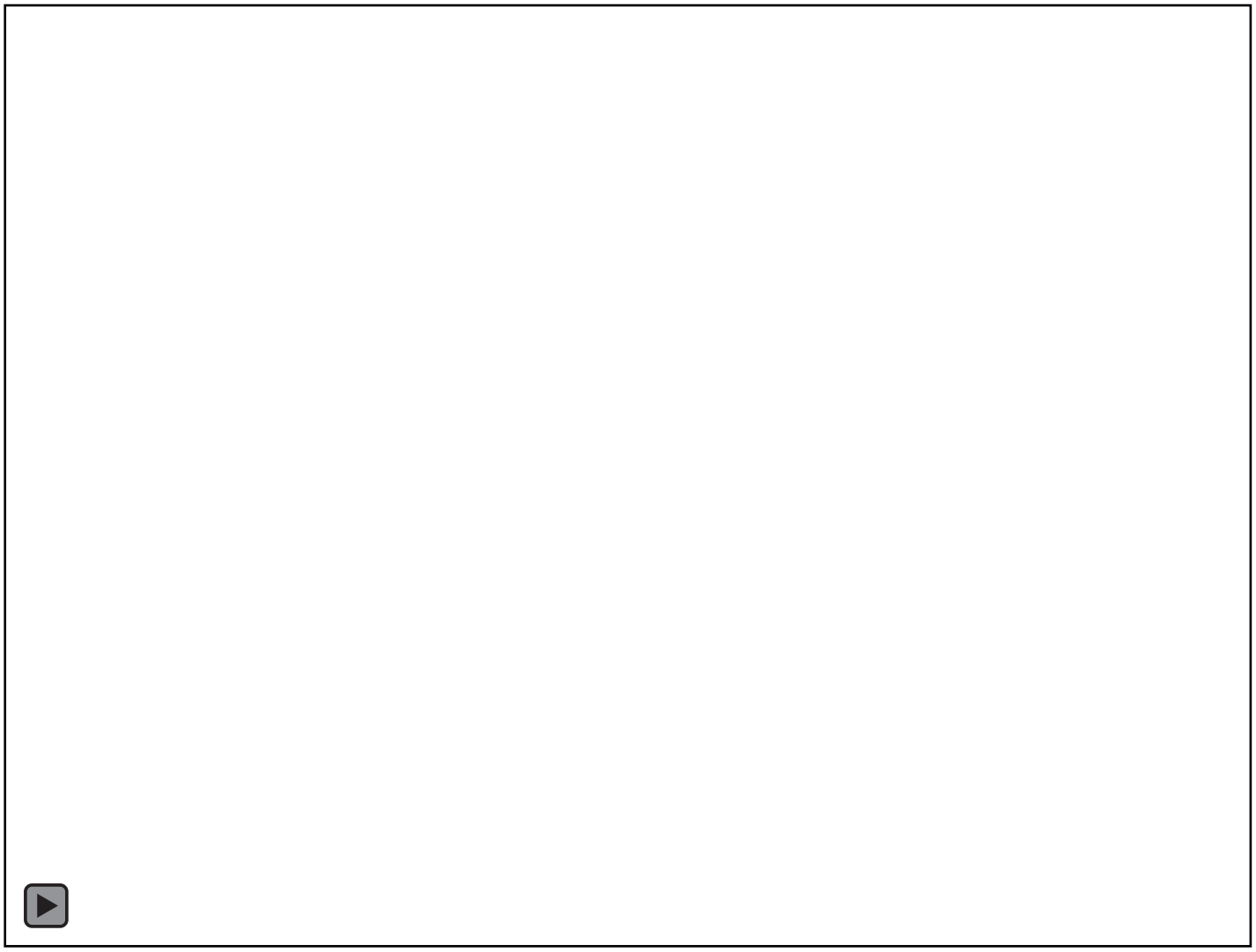
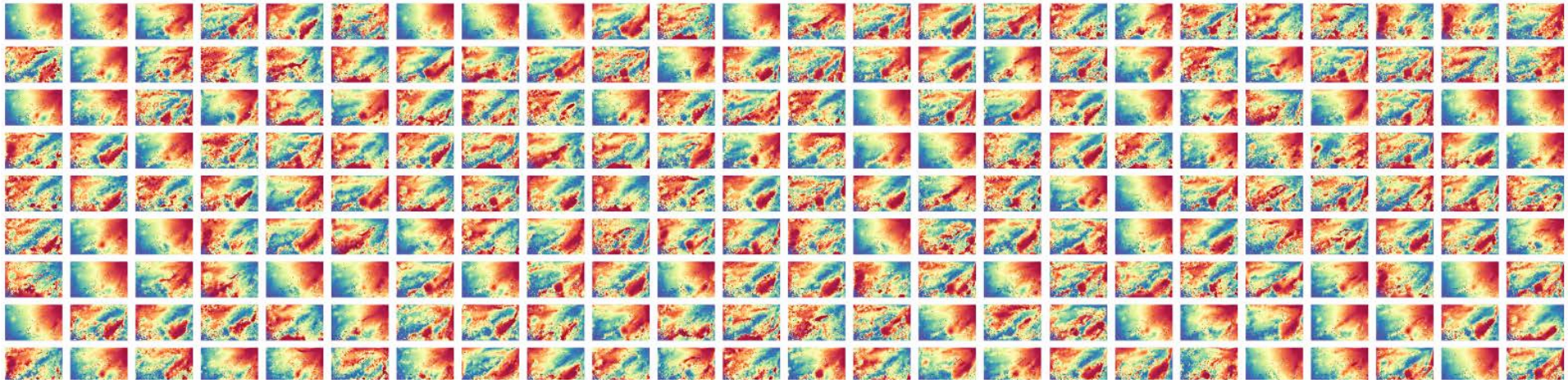
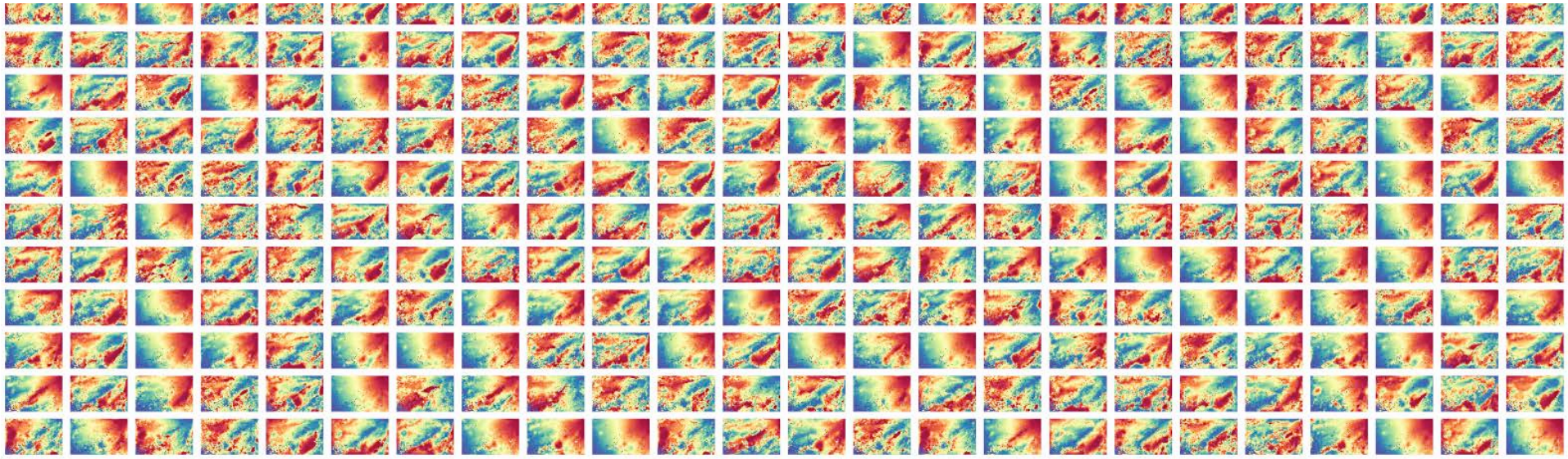






SPOKE Patient Representations for 300K+ Patients Spanning 137 Complex Diseases

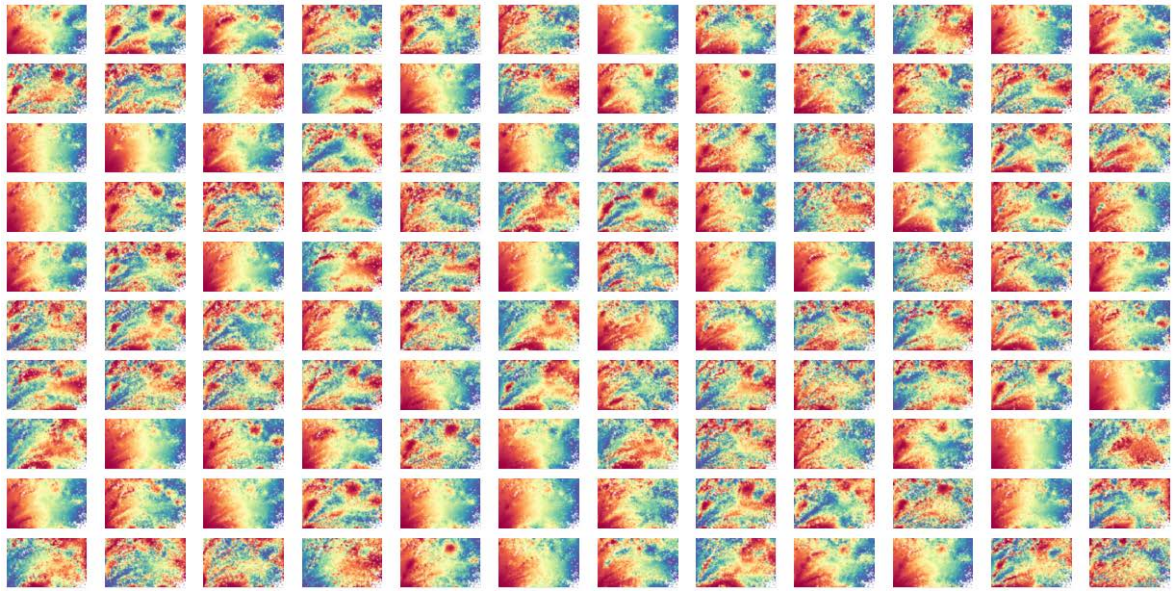


New Patient Cohort

4,357 PTSD Patients

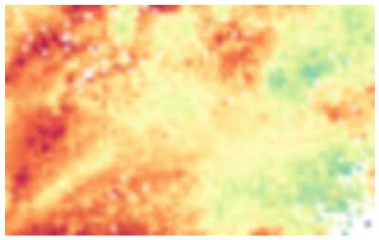
Add New Patient Record

Browse... No file selected

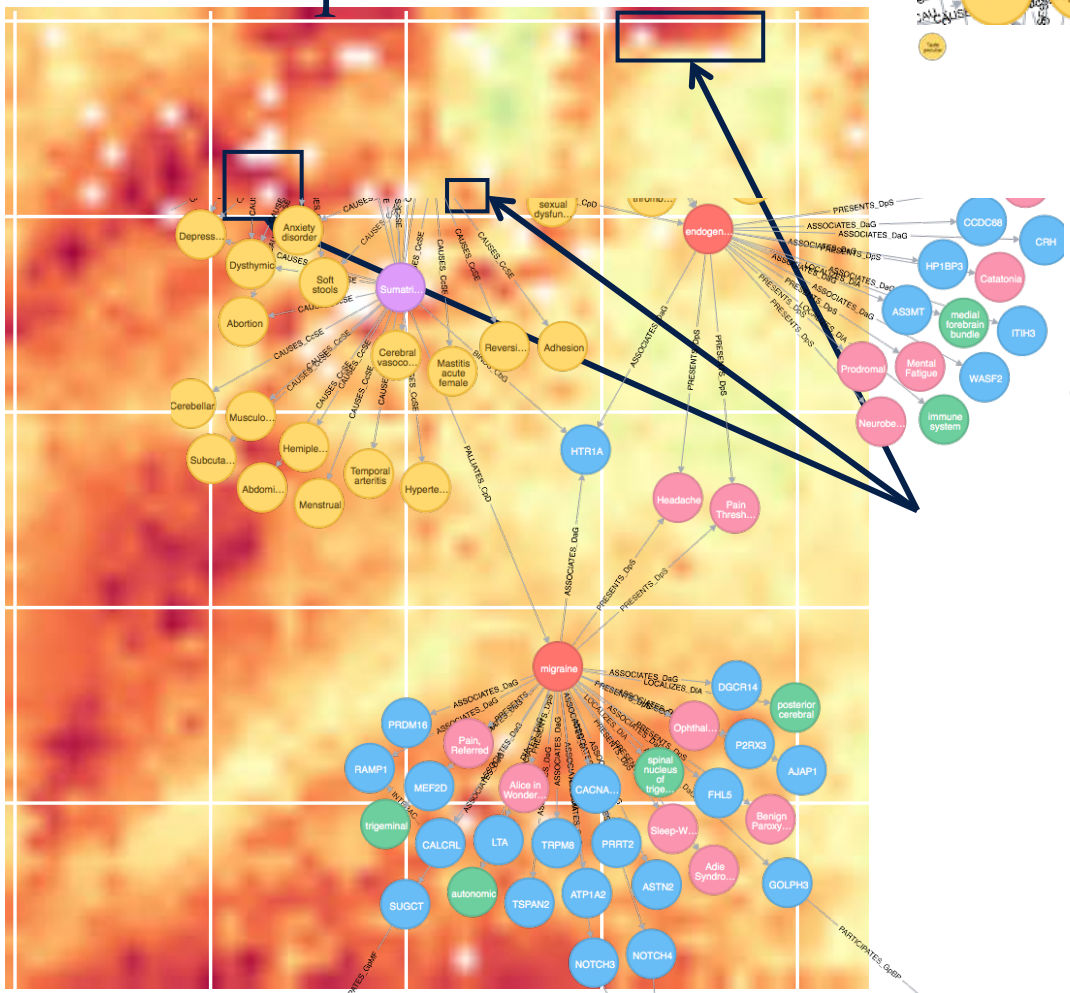


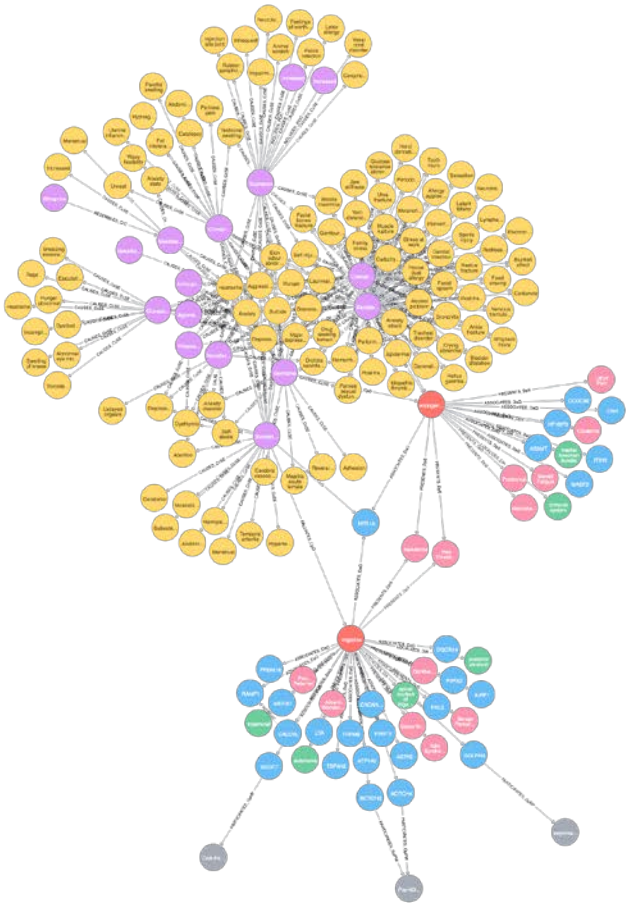
Most Similar Diseases to the Average PTSD Patient at UCSF

PTSD



Pixels That are Signi[illegible] Intense & Unique to PTSD

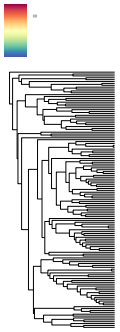


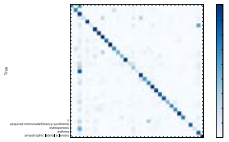


Applications Coming Soon

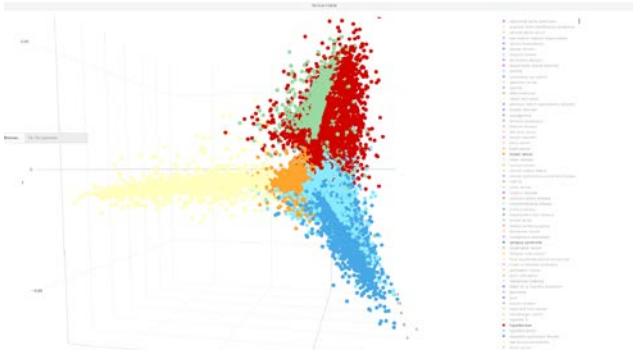
Disease Patterns

Disease Prediction

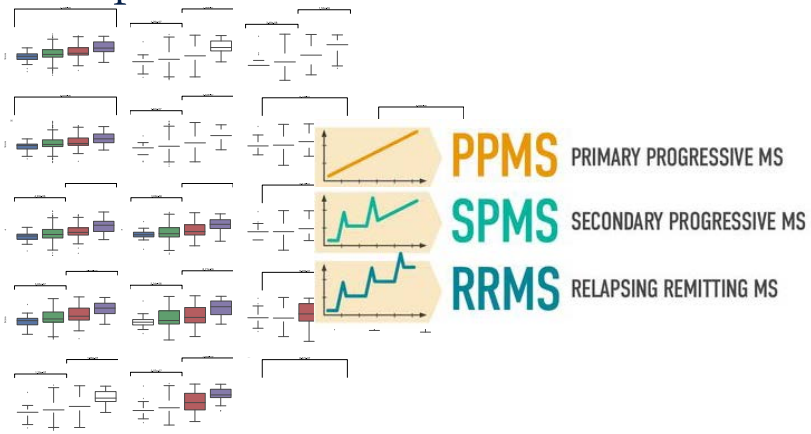




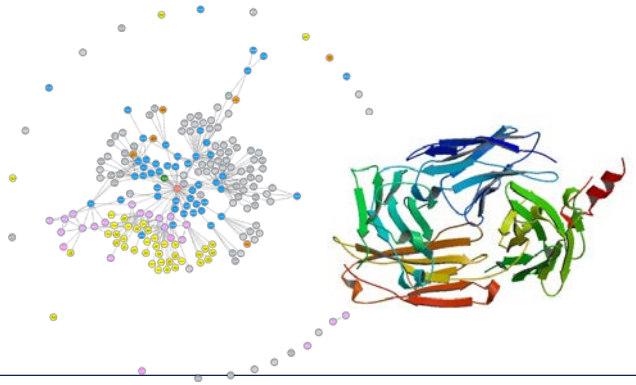
Patient Stratification



Multiple Sclerosis Disease Course



Drug Signatures



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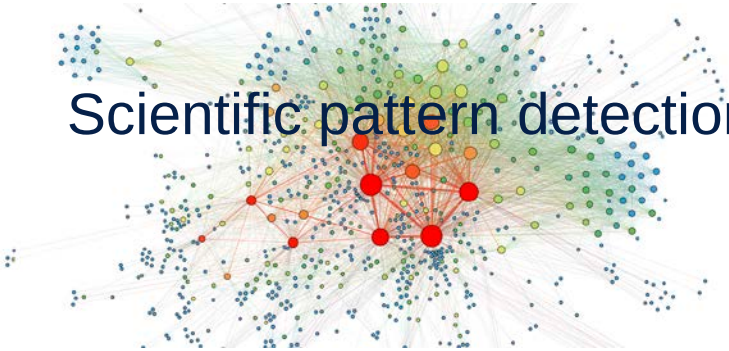
Knowledge Network is Fundamental to Biomedical Predictions

Combine Biology, Chemistry, Computer & Data Sciences

- Chances that this TBI patient will have suicidal tendencies?
- Will stem cell therapy work for this hepatoma patient?
- …



- Congenital CV risk factors in underserved populations?
- What can we learn about protein expression by combining selected GWAS and PheWAS?
- …

Graph Theory

Three hundred years of algorithmic study

How will it help

biomedical and health pathway discovery?

Thank You

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