

Ali Yazdizadeh

Masters in Biotechnology (Bioinformatics Specialization)
University of Tehran, Iran

Jan 2026 - UNIL PhD Fellowship -
Thesis Director: Prof. Dessimoz

My Background



MAX-PLANCK-GESELLSCHAFT

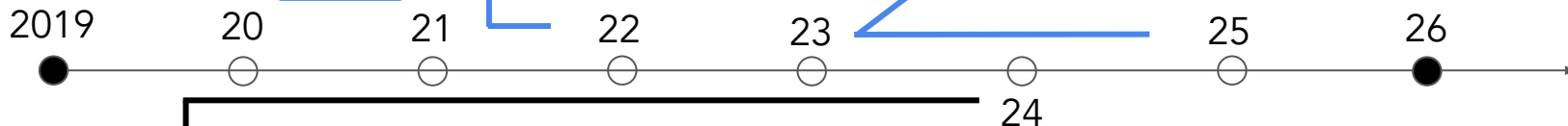
Remote Internship:
Lead the computational work in
AI for Optimization of Biosystems



Remote Internship:
Use of AI in COVID 19 Vaccine Side Effect
Prediction
Supervised by Dr. Nahal Mansouri



Part Time Software
Engineer
in Netherlands



BSc Biotechnology
at Uni Tehran



Summer Undergraduate Research: Contributed to
Orthology inference at scale with FastOMA
Nature Methods, 2025

DESSIMOZ LAB
Computational Evolutionary Biology

My Background



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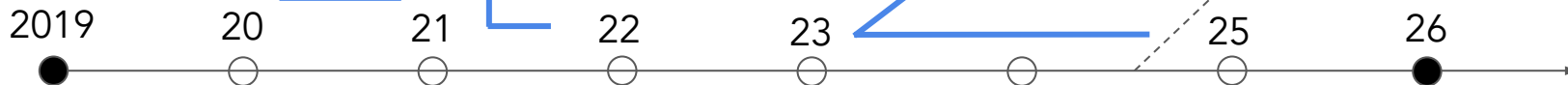
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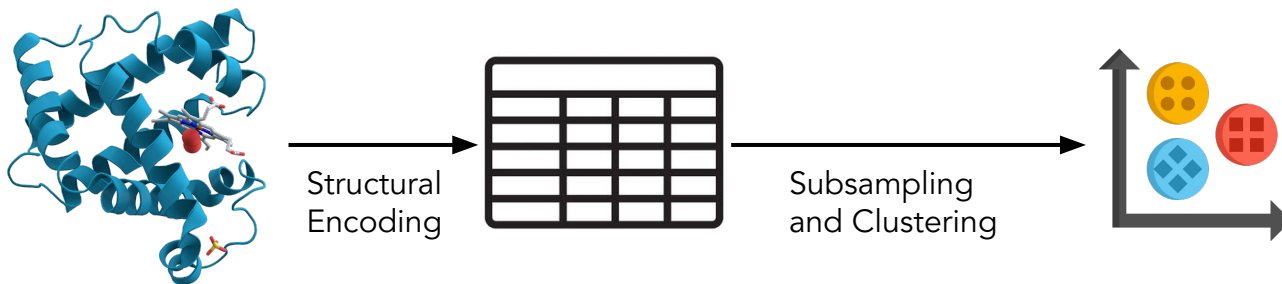
Summer Undergraduate Research: Contributed to
Orthology inference at scale with FastOMA
Nature Methods, 2025
Writing Review Article on Genomic Minimizer

MSc Biotechnology
at Uni Tehran



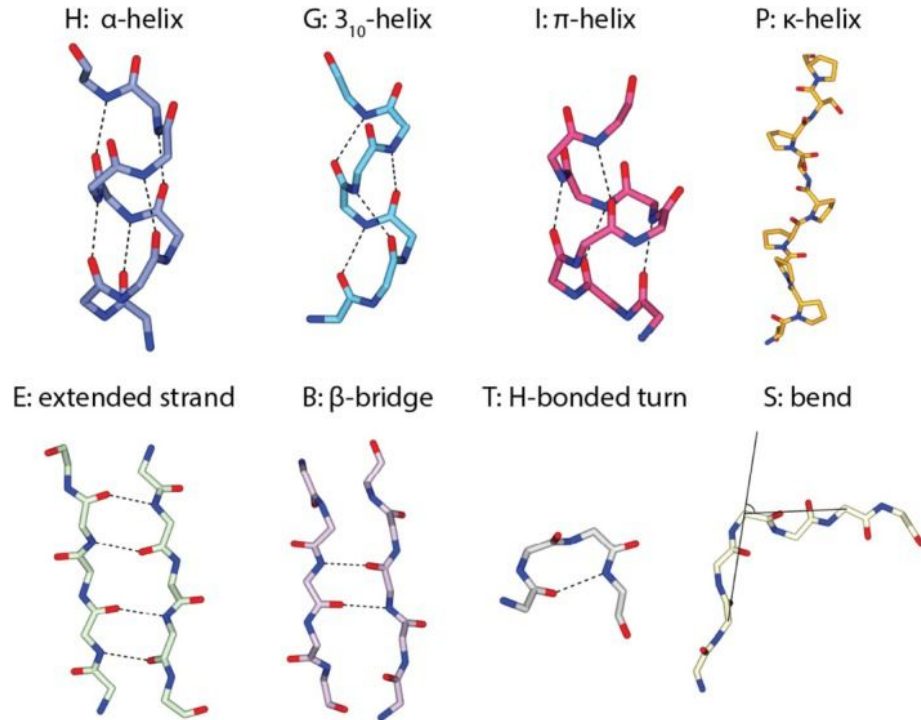
Masters Thesis (Supervised by Prof. Marashi)

Revisiting Protein Secondary Structures in the Age of Structural Data Abundance

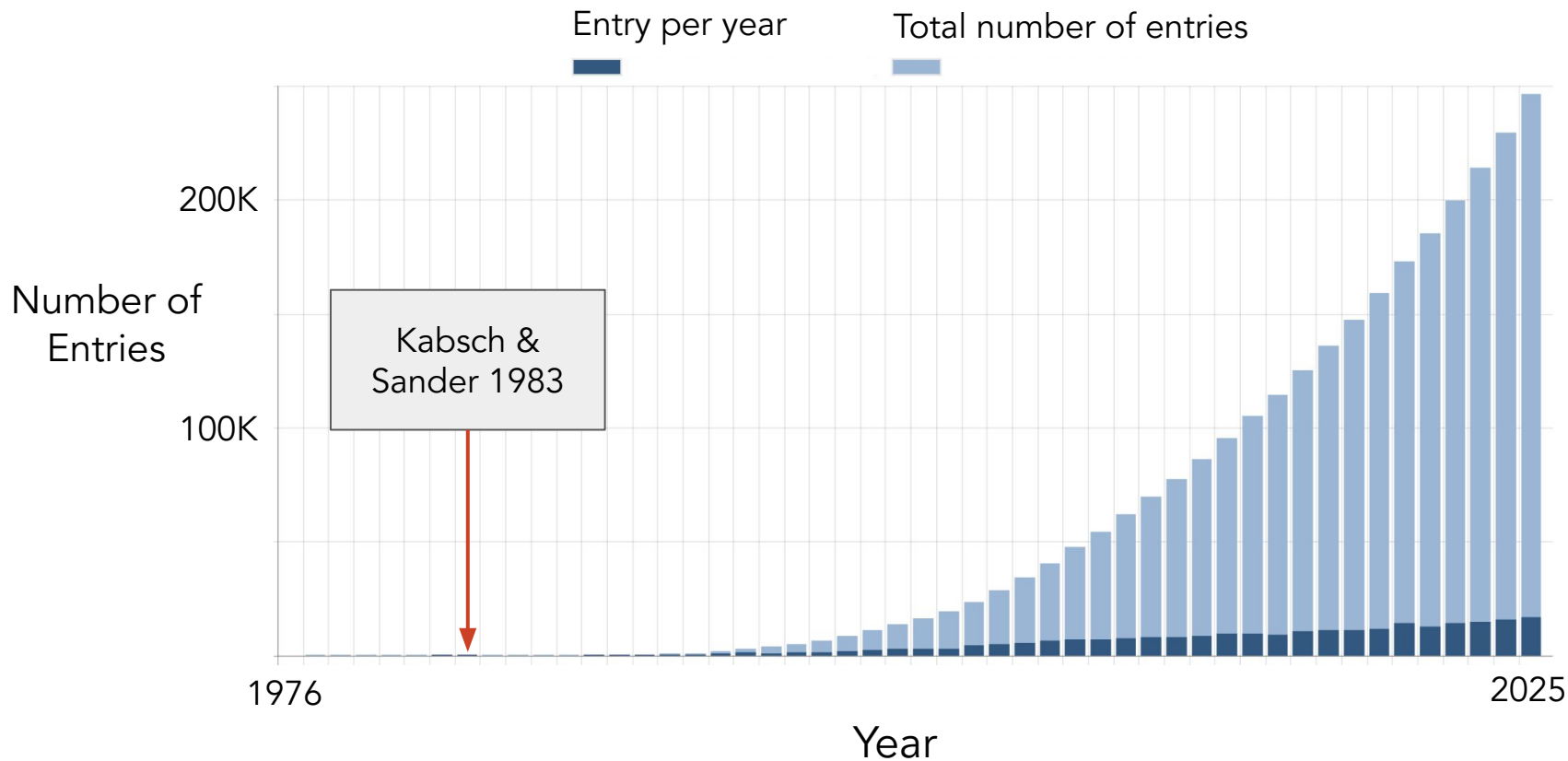


Protein Secondary Structure Classes

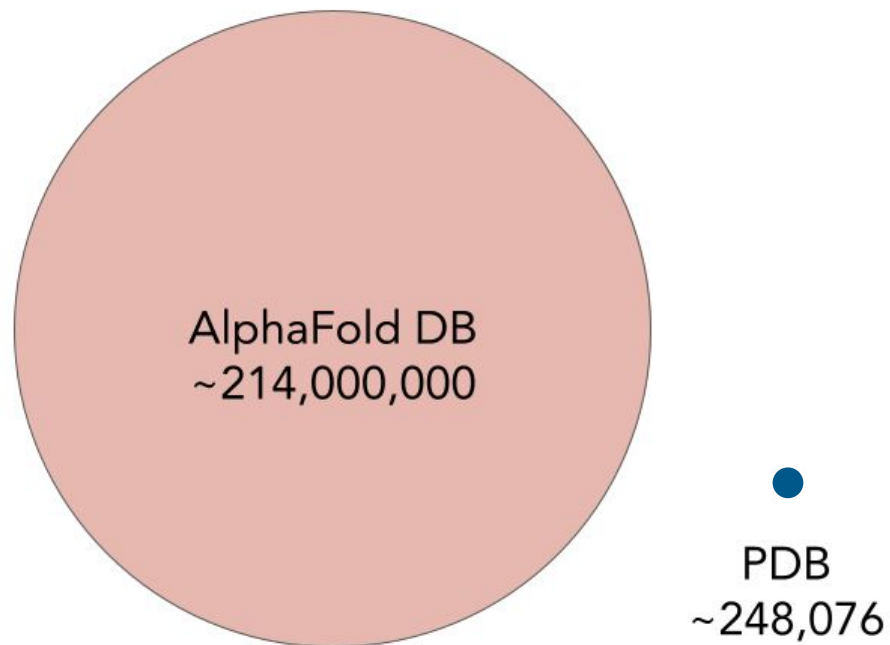
(Kabsch & Sander 1983)



Protein Data Bank (PDB) Growth



AlphaFold Revolution

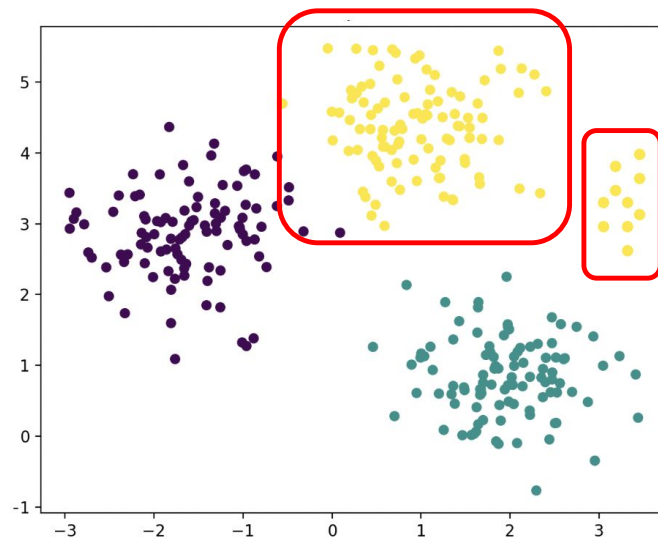
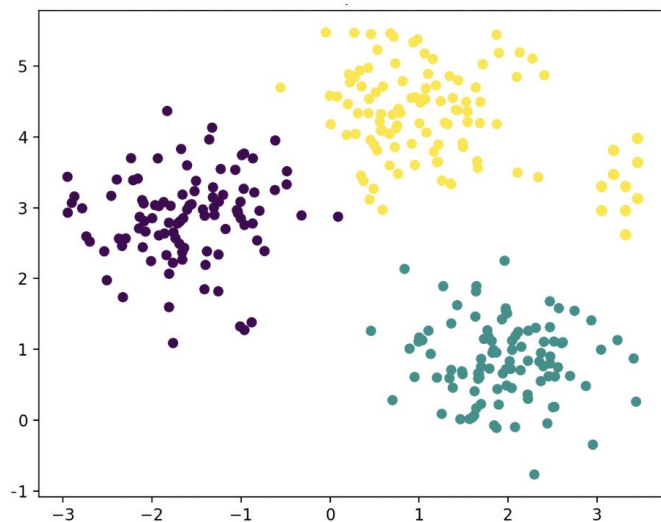


Based on December 2025 data

Thesis idea: improving the secondary structure classification

Main Questions:

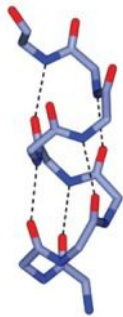
1. Is there a better way to define the classical secondary structure groups?
2. Are there any undiscovered group, previously ignored due to small dataset size?



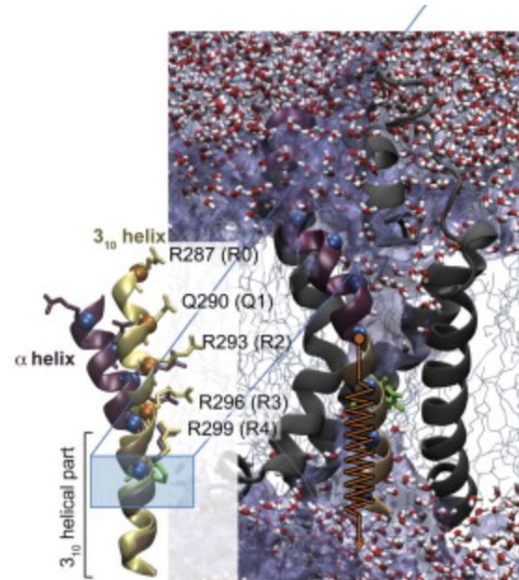
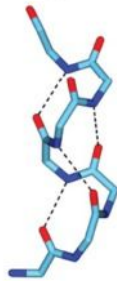
Why this matters?

- Secondary Structure classes have functional implications
 - Switch between 3_{10} helix and α helix can regulate the potassium ion channels.

H: α -helix



G: 3_{10} -helix

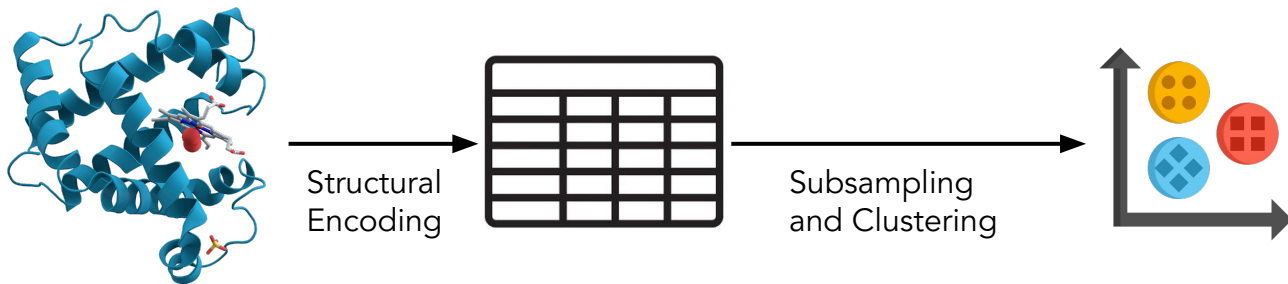


Overview of the Workflow

~6000 Protein Chain

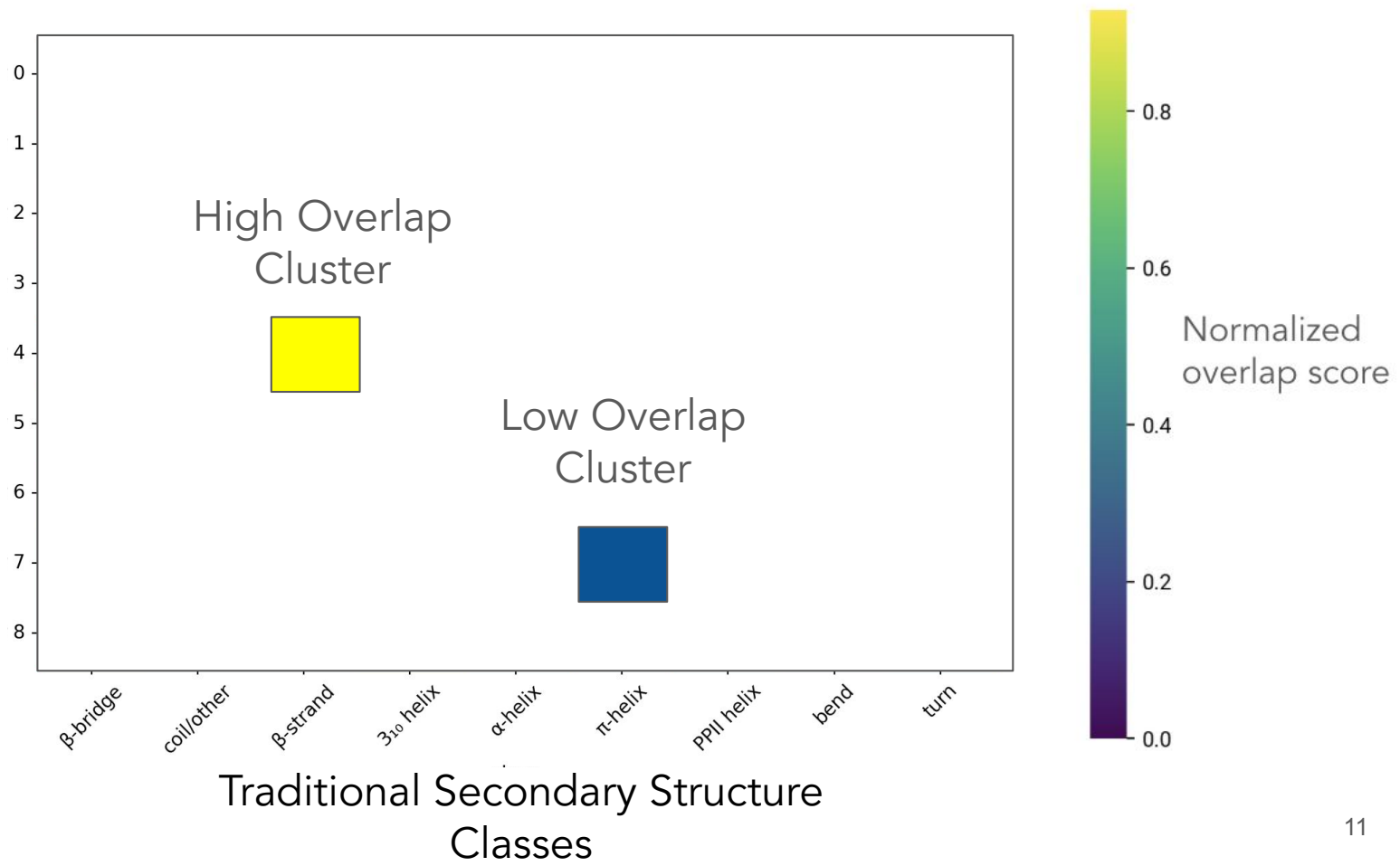
~1.5M Amino Acids

8 Clustering Methods Tested



~500 CPU hours of computation were done on Amazon (AWS) servers funded by a grant I obtained.

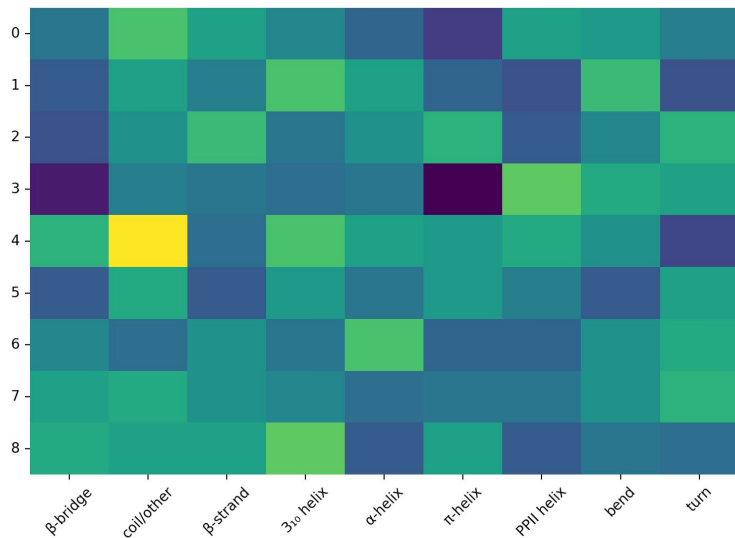
Newly
Computed
Clusters
(unsupervised)



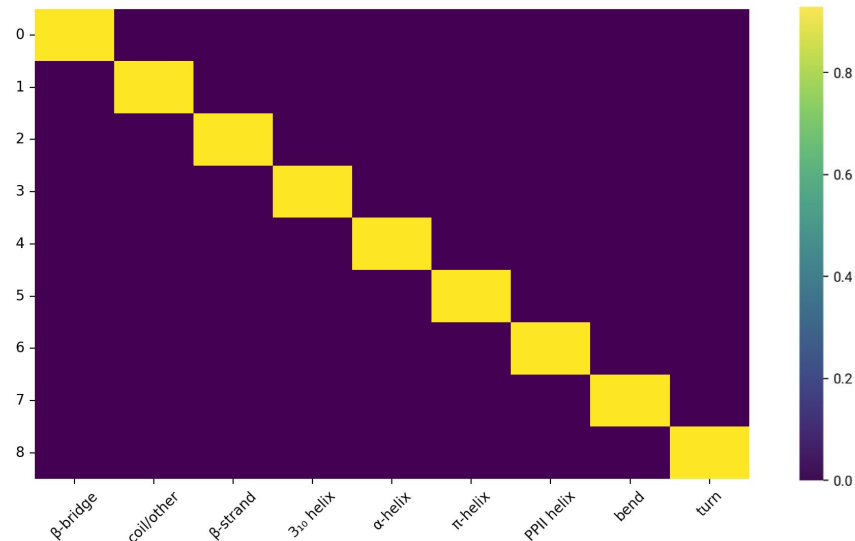
Examples of Potential Outcomes

Low agreement

New
Clusters



Complete agreement

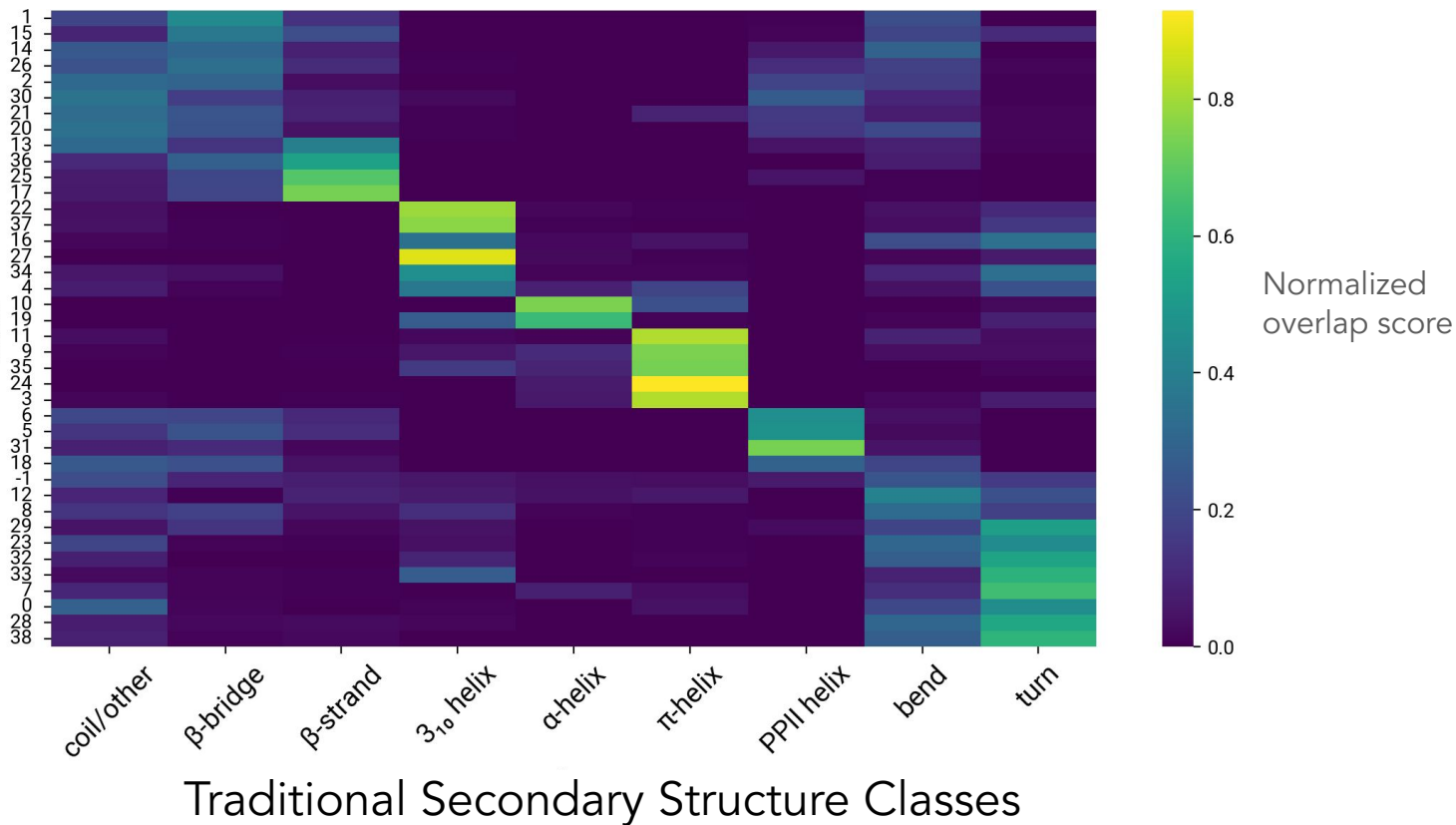


Traditional Secondary Structure
Classes

New Clustering Result

Substantial overlap with traditional classes, but also new insights

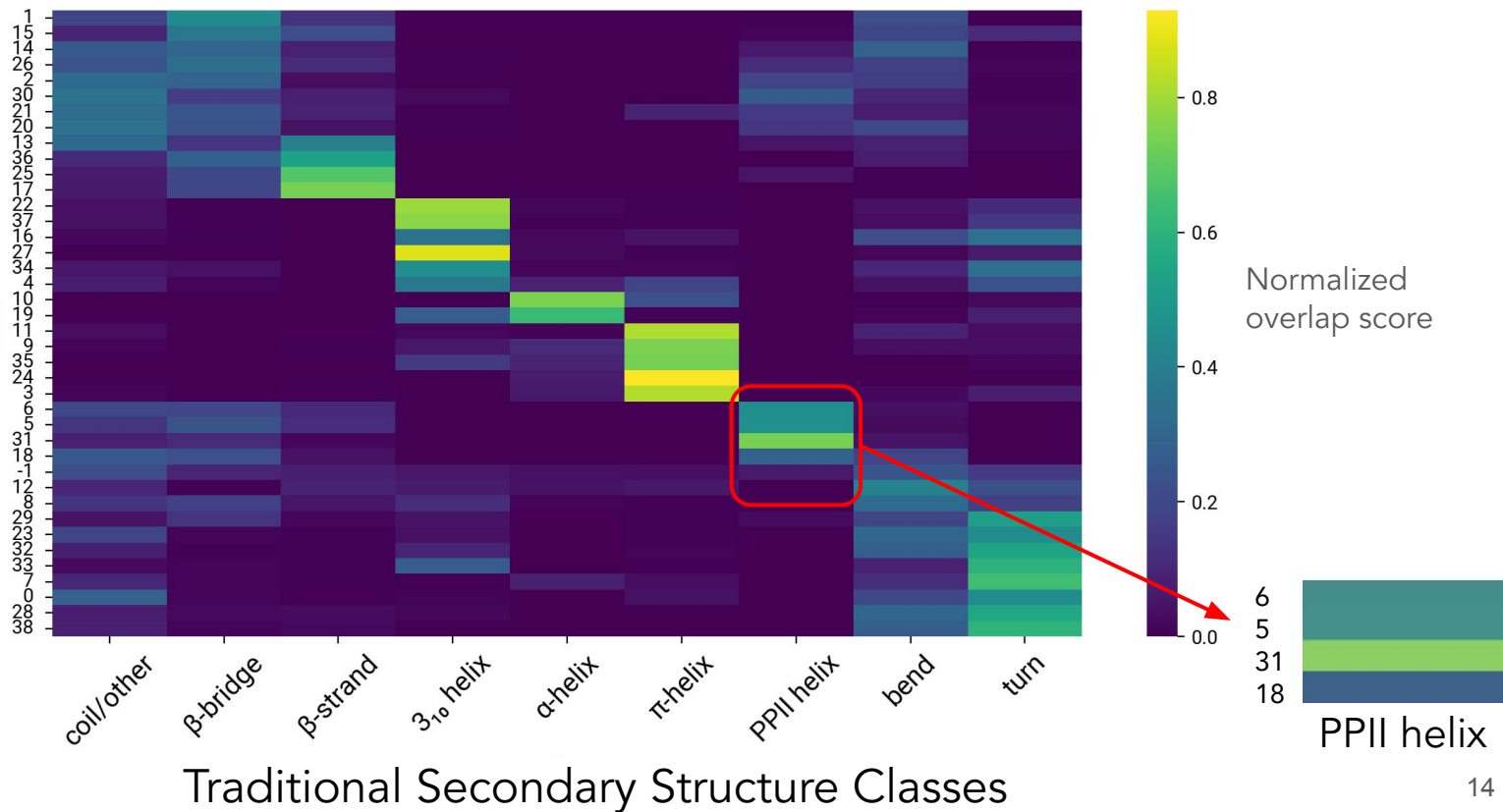
Our Computed
Clusters



New Clustering Result

Substantial overlap with traditional classes, but also new insights

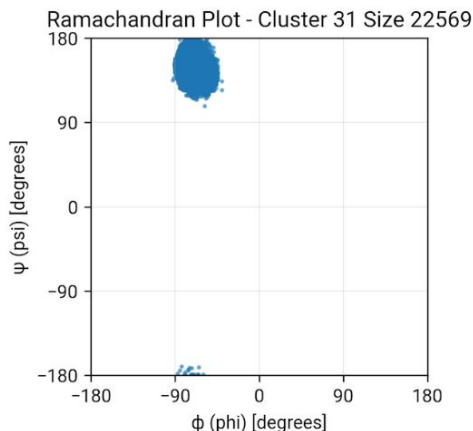
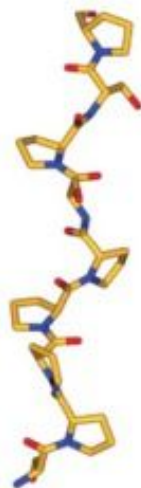
Our Computed
Clusters



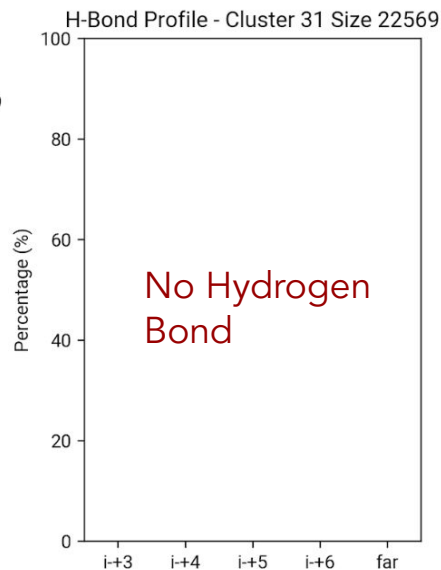
Notable Founded Clusters: Redefining Known Groups

A Better Defined Standard PPII Helix Group

P: κ -helix



Dihedral
Angles



Hydrogen-Bond
Pattern

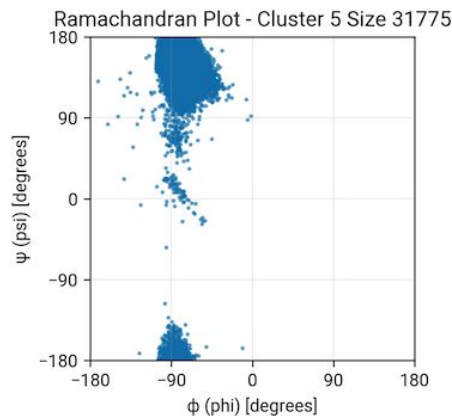


Notable Founded Clusters: Potential New Groups

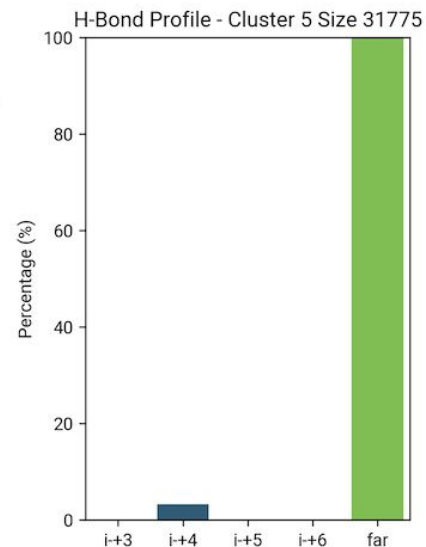
Hydrogen-Bonded PPII Helix



Snow Flea Antifreeze
Protein (2pne)



Dihedral
Angles



Hydrogen-Bond
Pattern

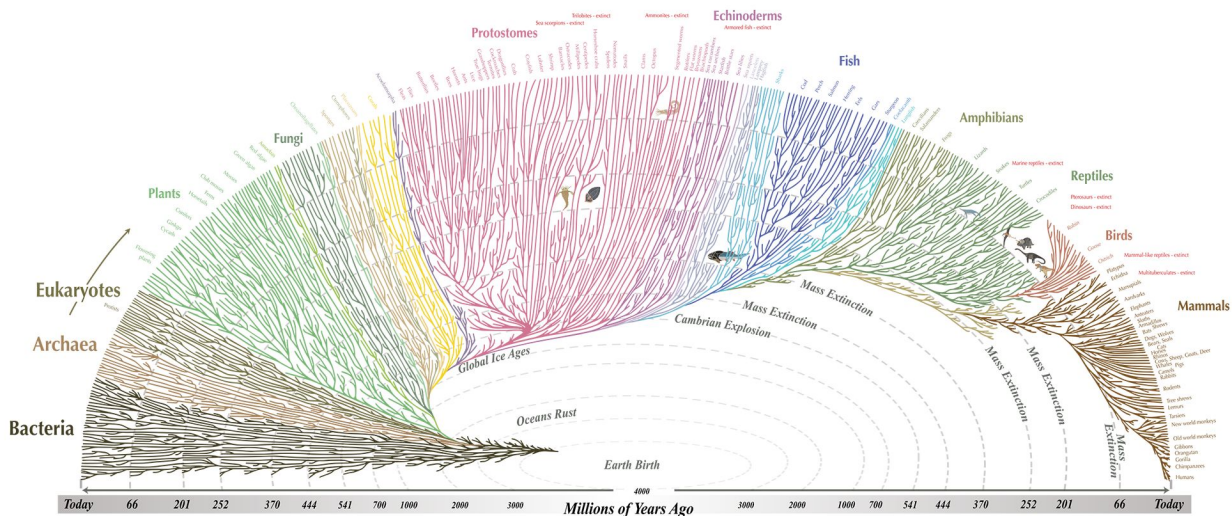


Conclusion

- There is a need to systematically reconsider traditional secondary structure classes, which can lead to discovery of new groups with functional implication.
- Our resulting clusters showed some traditional secondary structure groups can be defined with more resolution e.g. PPII helix and its hydrogen bonded subclass.
- Our result also suggests that some traditional secondary structure groups i.e. "bend" have poor geometrical homogeneity.

PhD at Unil: Reconstructing a comprehensive Tree of Life integrating gene family evolution signals

- Many genomes are being sequenced
- Traditional methods can not handle this size of data
- Develop fast and scalable methods to reveal evolutionary history of all species



All the major and many of the minor living branches of life are shown on this diagram, but only a few of those that have gone extinct are shown. Example: Dinosaurs - extinct

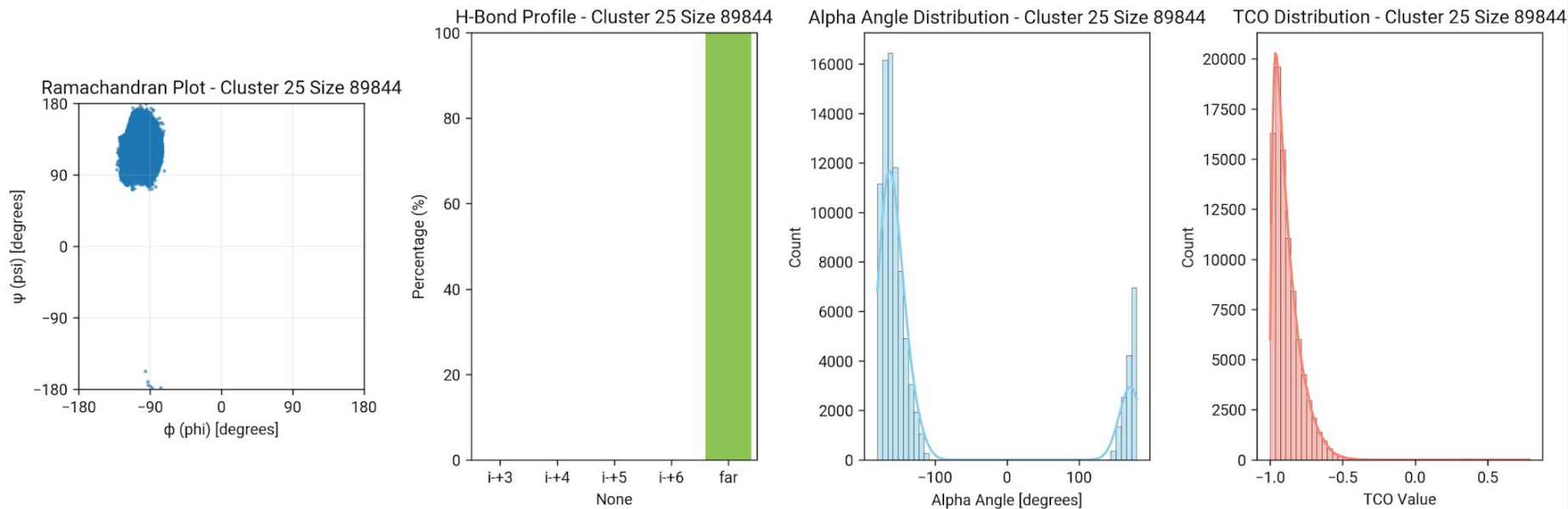
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evogeneao.com

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Appendix: In case needed to follow up questions

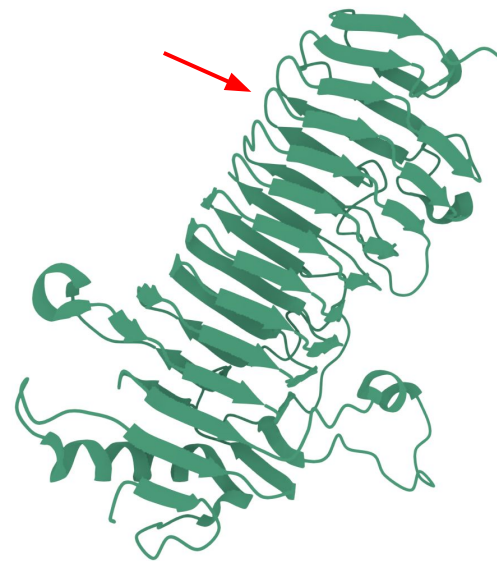
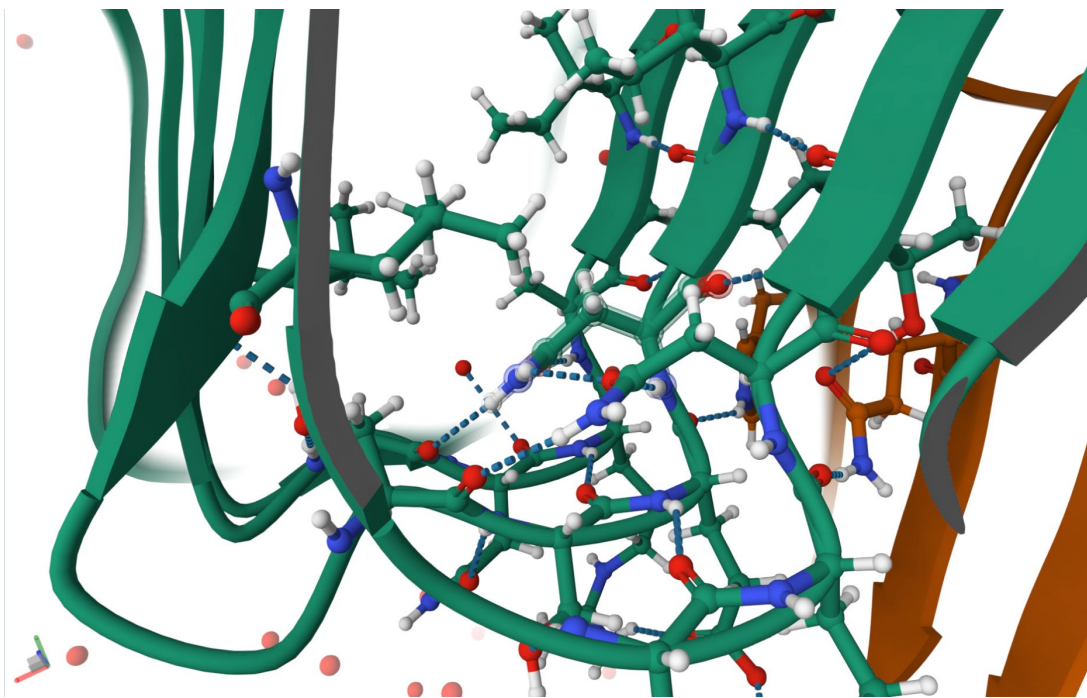
Notable Founded Clusters: Potential New Groups

“Turn Stabled by Far H-Bond” or “Turned Beta Sheet”



Notable Founded Clusters: Potential New Groups

“Turn Stabled by Far H-Bond” or “Turned Beta Sheet”



PDB ID: 8hui

Clustering Result Showing Cluster Consensus with the Unseen DSSP Labels

