JAMES WILLSON

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SUMMARY

Fifth year PhD student in Computer Science at the University of Illinois Urbana-Champaign researching computational biology. My research has focused on both developing methods with good empirical performance as well as theoretical guarantees.

EDUCATION

University of Illinois Urbana-Champaign *Fall 2020 – Current*
Ph.D. in Computer Science (In Progress)
GPA: 3.82

University of Memphis *Fall 2017 – Spring 2020*
B.S. in Computer Science
B.S. in Mathematical Sciences
GPA: 4.00

RESEARCH EXPERIENCE

Warnow Lab Spring 2021 – Present

Researched species tree estimation from gene trees under model accounting for gene duplication and loss; this collaborative multi-disciplinary research project resulted in the development of DISCO—software that is used to assist with large-scale species tree estimation from gene trees. Additionally, I researched the theoretical properties of graph clustering algorithms; these algorithms are useful in applications such as community detection. Currently, I am researching techniques for estimating phylogenetic networks.

Undergrad Research Summer 2019 – Spring 2020

Worked on funded research examining fine-grained complexity, related specifically to reducing the runtime of an algorithm for minimizing binary decision trees.

PUBLICATIONS

- Willson, J. and Warnow, T., (2024). Axioms For Clustering Simple Unweighted Graphs: No Impossibility Result. *PLOS Complex Systems.* 1 (2), 27 pages. URL: `https://doi.org/10.1371/journal.pcsy.0000011`
- Willson J., Tabatabaee Y., Liu B., Warnow T. (2022). DISCO+QR: Rooting Species Trees in the Presence of GDL and ILS, *Bioinformatics Advances.* 3 (1), 7 pages. URL: `https://doi.org/10.1093/bioadv/vbad015`
- Willson, J., Roddur, M. S., Liu, B., Zaharias, P., & Warnow, T. (2021). DISCO: Species Tree Inference Using Multi-Copy Gene Family Tree Decomposition. *Systematic Biology.* 71 (3), 610-629. URL: `https://doi.org/10.1093/sysbio/syab070`
- Willson, J., Roddur, M. S., & Warnow, T. (2021). Comparing Methods for Species Tree Estimation with Gene Duplication and Loss. In *International Conference on Algorithms for Computational Biology* (pp. 106-117). Springer, Cham. URL: `https://doi.org/10.1007/978-3-030-74432-8_8`

IN PREPARATION

Currently working on developing fast and accurate algorithms for estimating phylogenetic networks. Specifically, a method that given a constraint tree and a set of quartets can estimate the optimal placement of edges into that network to maximize the number of induced quartets in polynomial time.

SOFTWARE

DISCO is a method for decomposing multi-copy gene-family trees while attempting to preserve orthologs and discard paralogs. These single-copy gene trees can be subsequently used by methods that can estimate species trees from single-copy gene trees such as ASTRAL or ASTRID in order to obtain an accurate estimation of the species tree. Code can be found here `https://github.com/JSdoubleL/DISCO`.

TALKS

- Willson, J. (2021, June 11th). Comparing Methods for Species Tree Estimation with Gene Duplication and Loss. *8th International Conference, AlCoB 2021,* Missoula, MT, USA, June 7–11, 2021.
- Willson, J. (2022, November 4th). DISCO+QR: Rooting Species Trees in the Presence of GDL and ILS. *ISCB-LA SoIBio BioNetMX 2022*, Querétaro, Mexico, November 3–7, 2022.

GENERAL EXPERIENCE & SKILLS

Technical Skills

- *Programming Languages:* Experienced with Python, Java, C, C++, Go, and R.
- *Software:* Experience with Visual Studio Code, Neovim, LaTeX, Git, and Android Studio.
- *Other Technical Skills:* Experience using Linux and the high performance computing cluster at the University of Illinois Urbana-Champaign.

Teaching Experience

- Teaching Assistantship for *CS 124: Introduction to Computer Science*, from Fall 2020 to Spring 2021, then Fall 2022 and Spring 2024 through Fall 2024.
- Teaching Assistantship for *CS 128: Introduction to Computer Science II* Spring 2025.

HONORS AND AWARDS

University of Illinois Urbana-Champaign

Ira and Debra Cohen Fellowship (2021 - 2023)

University of Memphis

Peter I. Neathery Scholarship (College of Arts and Sciences)
Cecil C. Humphreys Presidential Scholarship
RP Clark Memorial Scholarship (College of Arts and Sciences)
RP and Dorothy Clark Outstanding Junior Award (College of Arts and Sciences)
Student Marshall (Collage of Arts and Sciences)