# GARY HOPPENWORTH

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## EDUCATION

**University of Central Florida**                                    *Fall 2017 - Summer 2020*
Double major in Computer Science and Mathematics                    Overall GPA: 3.94/4

**Relevant Courses:** Graph Theory I, Quantum Computing, Design and Analysis of Algorithms, Analysis I, Introduction to Topology, Introduction to Differential Geometry, Vector and Tensor Analysis, Abstract Algebra I, Probability and Random Processes.

## HONORS AND AWARDS

· Barry M. Goldwater Scholarship (2020)
· UCF Distinguished Undergraduate Researcher Award (2020)
· Burnett Honors College Scholar (2017 - Present)
· National Merit Scholar (2017)

## PUBLICATIONS

· Daniel Gibney, Gary Hoppenworth, and Sharma V. Thankachan. Simple Reductions from Formula-SAT to Pattern Matching on Labeled Graphs and Subtree Isomorphism. In *SIAM Symposium on Simplicity in Algorithms, SOSA@SODA 2021*
· Gary Hoppenworth, Jason W. Bentley, Daniel Gibney, and Sharma V. Thankachan. The Fine-Grained Complexity of Median and Center String Problems Under Edit Distance. In *28th Annual European Symposium on Algorithms, ESA 2020*
· Jason W. Bentley, Daniel Gibney, Gary Hoppenworth, and Sumit Kumar Jha. Quantifying Membership Inference Vulnerability via Generalization Gap and Other Model Metrics. *CoRR*, 2020
· Hideo Bannai, Travis Gagie, Gary Hoppenworth, Simon J. Puglisi, and Luís M. S. Russo. More Time-Space Tradeoffs for Finding a Shortest Unique Substring. *Algorithms*, 2020

## PROJECTS

**Hardness of the Unique-3SUM Problem**                              May 2020 - Present
*Research at UCF*

· Investigated the Unique-3SUM problem, a version of the 3SUM problem where we are promised that there either exists a unique solution or no solution at all.
· Gave an Isolation Lemma-type randomized reduction from Unique-3SUM to 3SUM, showing that a faster expected time algorithm for Unique-3SUM would imply a faster expected time randomized algorithm for standard 3SUM.
· This work was submitted to STOC 2021 with coauthors Parisa Darbari, Daniel Gibney, and Sharma Thankachan.

**New Lower Bounds for Two Problems on Graphs**                      May 2020 - August 2020
*Research at UCF*

· Worked with Professor Thankachan and Daniel Gibney to give new reductions from Boolean Formula Satisfiability (Formula-SAT) to the Pattern Matching on Graphs and Subtree Isomorphism problems.
· I will present this work at the SOSA21 conference.

**Generalizations of Edit Distance to $k$ Strings**                 August 2019 - March 2020
*Research at UCF*

· Studied the median and center string versions of edit distance on $k$ strings under Professor Thankachan and two graduate students.
· Used a reduction from MAX-CNF-SAT to prove that these problems cannot be solved in $O(n^{k-\varepsilon})$ time for any $\varepsilon > 0$ under the Strong Exponential Time Hypothesis (SETH).
· Presented this work at ESA 2020.

### Membership Inference Attack Problem
August 2019 - January 2020
*Research with the National Geospatial-Intelligence Agency*

· Worked with Professor Sumit Jha and two graduate students.
· Developed a simple membership inference attack algorithm that is theoretically optimal under certain conditions and performed comparably to state-of-the-art membership inference attack algorithms.
· Our work has since been declassified and is available in the CoRR on Arxiv.

### Extracting Regular Languages from Electronic Circuits
May 2019 - August 2019
*Research with the Air Force Research Laboratory (AFRL)*

· Worked under Professor Jha to extract regular language representations of the input/output behavior of old electronic hardware in order to verify its correctness.
· Used a fusion of program verification and machine learning methods.
· Presented a report to the AFRL on the successful preliminary results of my investigation.

### Shortest Unique Substring Problem
May 2018 - August 2018
*Research at UCF*

· Developed a new time-space tradeoff algorithm for the shortest unique substring problem under Professor Thankachan.
· Presented my work at the StringMasters Lisbon 2018 workshop.
· The resulting paper was published in a special issue on algorithms in bioinformatics in *Algorithms*.

## EXTRACURRICULARS

### Student Undergraduate Research Council
Fall 2019 - Present
*Outreach Officer*
UCF

· Gave classroom presentations on how to get involved in undergraduate research in STEM at UCF.
· Held information sessions on the resources available to students interested in undergraduate research at UCF.

### Algorithms and Theory Club
Fall 2020 - Present
*President*
UCF

· Founded this club with the goal of promoting CS theory in the UCF computer science curriculum and among the student body.
· Hold weekly meetings where we learn new algorithms and data structures and solve interesting puzzle problems.

### Special Olympics
Winter 2016 - Present
*Volunteer Ski Instructor*
*Hilltop Ski Area, Anchorage*

· Volunteered during winter and summer break with Special Olympics Alaska.
· Worked as a ski instructor and organizer for athletes with intellectual disabilities.