REU-CAAR: Research Experience for Undergraduates in Combinatorics and AI for Applied Research

William Gasarch-Director
John Dickerson-Co Director
Many Mentors!
Many Students!

Time and Money

1. June 5- August 11 (10 weeks)
   (If on campus then might have you arrive on June 4)
2. $6000 stipend
3. Housing and some Meal Money
4. Excellent student-to-teacher ratio.
5. For more info
   https://www.cs.umd.edu/projects/reucaar/

Activities

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8. Presentation on Ethics of Research

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10. Making friends for life! (now possibly with Facebook). (When I first ran the program in 2013 this was novel!)

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3. Next slides describe **THE PROJECTS!**
4. The projects range from THEORY to PRACTICE.

Classical and Quantum Error Correction

Mentors Victor Albert and Phillipe Faist

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Quantum Communication which also needs error correction.

The project will study both classical and quantum error correction and help build the `ErrorCorrectionZoo`, a website of classical and quantum error correction schemes.

Improving Machine Translation for Wikipedia

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We will the use what we learn to have Machine Translators that detect and correct errors.

Parallel Algorithms for High-Dimensional Clustering

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Parallelism!

We design and implement **Parallel** algorithms for clustering. We then apply them to known benchmarks and see how they do.

Induced Ramsey Theory

Mentor William Gasarch

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More generally find for a graph H a small graph G such that for all 2-colorings of the edges of G you get a monochromatic H.

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G, when you color the edges of G, do you get a mono K_3?
More generally find for a graph H a small graph G such that for all
2-colorings of the edges of G you get a monochromatic H.
Will learn LOTS of combinatorics! LOTS of Ramsey Theory!

Fair Decision Making

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In this project we will use AI to learn bias patterns missed by humans and hence improve fair ML's in a dynamic way.

Computational Hilbert Geometry

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We will explore what happens to Computational Geometry problems when you use a different distance. You will learn Comp Geom and combine Comb Geom with programming.

Using Markov Decision Processes to Mitigate Climate Risk

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In India the farmers are vulnerable to climate risk. Giving them crop advice is crucial.

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Description

In India the farmers are vulnerable to climate risk. Giving them crop advice is crucial.

This project will develop tools to actually help them plan. It is in conjunction with a non-profit organization KHEYTI
`https://www.kheyti.com/`

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   - ▶ Grad School
   - ▶ Work on Math problems together!
   - ▶ Professional Talks

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7. There will be presentations of the projects.

Qualifications

1. Discrete Math (or good math background). Algorithms a plus.
2. Knowing how to program.
3. See website for prerequisites for some projects.
4. US Citizenship for NSF funding. But see next point.
5. We have some (not alot!) money for non-citizens.

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How to apply: Goto the website!

Will need:

1. Transcript (including Fall 2022)
2. Statement of Purpose (say which 3 or 4 projects you want to work on, WHY you are interested and WHY you are qualified)
3. Letters of rec. (Letter writers will submit those)
4. Other stuff that is on form

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   If you **ACCEPT** then we look forward to seeing you in June!

Advice for ANY REU-app, Grad School App

1. Apply Early.
2. Get your personal statement done ASAP.
3. Personal Statement should elaborate on what you want to work on, why you are qualified, and why you're interested.
4. Apply to many places (REU programs— Google NSF REU to find more programs).

Quotes from Former Students (2021)

This REU experience was greatly beneficial in expanding my knowledge and experience with machine learning. Dr. Gasarch, the mentors, my team, and the professors were all very supportive and encouraging, and I learned so much from them over the course of the program. The program was a perfect way to explore different research aspects and allow me to get a better idea of how research is conducted. I am very thankful for this experience.

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Aside from the research, the lunches and talks were interesting. Thanks to Professor Gasarch, his helper Auguste, and all the mentors. I would recommend it to anyone interested in computer science or mathematics.

Another REU Program at Univ of MD

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1. Most of what I said about REU-CAAR also apply to REU-BRIDGE.
2. REU-BRIDGE website is:
   `https://www.cbcb.umd.edu/summer-internships`
3. Mihai Pop is the director of REU-BRIDGE.

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3. Get a taste of graduate school
4. Have a great time!

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Final Takeaway Apply to REU programs that spark your interest, and consider REU-CAAR and REU-BRIDGE.