Andrew Zhu

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Research Interests

Natural language processing; programming languages; distributed systems and algorithms; low-power systems and edge computing; distributed machine learning; Byzantine fault tolerance; volunteer computing.

Education

PhD in Computer and Information Science 2022 - Present
University of Pennsylvania

BS in Computer Science 2018 - 2021
University of California, Santa Cruz
I graduated in 3 years with a cumulative GPA of 3.97 out of a possible 4.00, highest honors in the major, and university honors, *summa cum laude*.

Research Experience

Research Fellow 2022 - Present
Department of Computer and Information Science, University of Pennsylvania

Undergraduate AI Research 2019
Department of Computer Science and Engineering, University of California, Santa Cruz

- Assisted in Professor Yang Liu's research in applying theory from crowdsourced judgment elicitation to generative adversarial networks
- Contributed an implementation of multi-discriminator ("peer" or "duel") GANs later developed in the publication *DuelGAN: A Duel between Two Discriminators Stabilizes the GAN Training* (2021)

Publications

Papazov, S., Gill, W., Garcia Ferreiro, M., **Zhu, A.**, Martin, L., Callison-Burch, C. (2022). *Using Language Models to Convert Between Natural Language and Game Commands.* NAACL 2022 Wordplay Workshop.

Wei, J., Liu, M., Luo, J., **Zhu, A.**, Li, Q., Davis, J., Liu, Y. (2022). *DuelGAN: A Duel Between Two Discriminators Stabilizes the GAN Training.* European Conference on Computer Vision.

Products/Professional Experience

Avrae Developed independently 2016 - 2019
https://avrae.io/ D&D Beyond, Wizards of the Coast 2019 - Present
https://github.com/avrae/avrae

- Unique open-source Discord application, web API, and website providing intuitive dice rolling, initiative tracking, and other services for users to play Dungeons & Dragons online, serving over 5 million users
- Developed a distributed startup system to coordinate startup and synchronization of 300+ application shards across 8 clusters to facilitate software upgrades
- Implemented two custom languages and interpreters to facilitate running thousands of user scripts server-side safely with strict upper bounds on resource usage (see Open Source)

Software Engineer 2019 - Present
D&D Beyond, Wizards of the Coast

- After D&D Beyond's acquisition of Avrae (see above) in May 2019, continued development of product as lead software engineer on the Discord team
- Architected and implemented companion website, modding API, and copyrighted data entitlement system to serve customers and generate over $8M of revenue
- Collaborated with peers to integrate existing project with D&D Beyond's infrastructure and systems, including real-time communication and state synchronization

Open Source

Alongside my academic and professional career, I make numerous contributions to open source software, averaging over 2,000 contributions on GitHub each year. Some of my open source projects that inspired my research interests are listed below.

PaissaHouse + PaissaDB 2021 - Present
https://github.com/zhudotexe/FFXIV_PaissaHouse
https://github.com/zhudotexe/FFXIV_PaissaDB

- Distributed data collection agent to gather large amount of samples to reverse engineer timing mechanism in video game Final Fantasy XIV, with over 8000 volunteer contributors
- Central low-power edge server to collate, analyze, and archive data packets from network of data collection agents, processing over 5.3 million data points per day
- Prototyping systems to identify and mitigate impact of network and Byzantine faults (e.g. client timestamp errors) on time-series data in asynchronous model
- Developed a probabilistic approach to analyze collected data points to account for fluidity of data collection network
- Collecting results and analysis in mock paper to present to community of peers

Draconic Language 2020 - Present

https://github.com/avrae/draconic

- Server-side scripting language to allow users to write powerful user commands while enforcing limits on server resource usage
- Implemented subset of Python in custom interpreter with novel safe types and bindings to parent application's Python API to run user scripts on the application layer
- Used in production in Avrae (see Products) to run over 75,000 user scripts daily

d20 2020 - Present

https://github.com/avrae/d20

https://pypi.org/project/d20

- Dice rolling library including custom grammar and interpreter to represent, roll, and modify complex dice expressions and results
- Built to be extendable, fast, safe, memory efficient, and project-agnostic
- Used in production in Avrae (see Products) to handle over 1 million dice rolls daily

Honors and Awards

Highest Honors in Computer Science, University of California, Santa Cruz	2021
University Honors, *summa cum laude*, University of California, Santa Cruz	2021
Phi Beta Kappa	2021 - Present
Dean's Honors, University of California, Santa Cruz	2018 - 2021
Caldwell Merit Scholarship, University of California, Santa Cruz	2018 - 2021
CruzHacks Winner: Tech Cares, Best Use of Google Cloud Platform	2019

Projects & Activities

Iris 2019

CruzHacks, University of California, Santa Cruz

- Winner at CruzHacks 2019: collaborated with four others to produce an AI-powered virtual assistant using facial recognition to help Alzheimer's patients combat memory loss
- Presented methods and results at *Santa Cruz New Tech Meetup* (2019)

Control Systems Advisor 2018 - 2022

Team 2144, Sacred Heart Preparatory, Atherton

- After serving as the team's software and electrical lead for 4 years in high school, I returned to mentor later students on more advanced topics, including machine learning and computer vision
- Prepared lectures and demonstrations for high school students implementing robotic control algorithms, acted as volunteer CSA at team-hosted FIRST competitions

References

Available upon request.