Hanhan Zhou

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SUMMARY: Current Ph.D. student with full-stack programming knowledge and a wide range of working and project experience in machine learning, research areas include **Reinforcement Learning, Distributed Learning, Generative and Foundation Models, Recommendation Systems and Natual Language Processing**.

Education

- **The George Washington University** — Washington, DC
  Ph.D. Student in Department of Electrical and Computer Engineering — *Sept 2019 - May 2024 (Expected)*
  Research Interests: Reinforcement Learning, Distributed Computing, Generative Models, Recommendation Systems, Cyber Security
- **The George Washington University** — Washington, DC
  M.S. - Electrical and Computer Engineering — *Sept 2017 - May 2019*
  Core Courses: Design & Analysis of Algorithm, Computer System Architecture, Embedded Systems, Telecommunications Security
- **Zhejiang Sci-tech University** — Hangzhou, China
  B.S. - Electronic and Information Engineering — *Sept 2013 - May 2017*

Skills Summary

- **Languages**: Object Oriented Design with **Python**, **JAVA**, **Go**, **Kotlin**, **JavaScript**
- **Frameworks**: PyTorch, Scikit, TensorFlow, Caffe, Keras, Spring, Android Studio, React
- **Tools**: Kubernetes, Docker, GIT, Jenkins, JIRA, Maven, Gradle, MongoDB, MySQL

Selected Publications & Preprints

- Yongsheng Mei, **Hanhan Zhou**, Tian Lan, "Projection-Optimal Monotonic Value Function Factorization in Multi-Agent Reinforcement Learning": Accepted at the Int. Conf. Auton. Agents & MultiAgent Syst (AAMAS) 2024.
- Huiqun Li, **Hanhan Zhou**, Yifei Zou, Dongxiao Yu, and Tian Lan, "ConcaveQ: Non-Monotonic Value Function Factorization via Concave Representations in Deep Multi-Agent Reinforcement Learning": Accepted at the AAAI conference on Artificial Intelligence (AAAI), 2024.
- **Hanhan Zhou**, Tian Lan, Guru Venkataramani, Wenbo Ding, "Every Parameter Matters: Ensuring the Convergence of Federated Learning with Dynamic Heterogeneous Models Reduction": Accepted at Conference on Neural Information Processing Systems (NeurIPS), 2023.
- **Hanhan Zhou**, Tian Lan, and Vaneet Aggarwal, "Value Functions Factorization with Latent State Information Sharing in Decentralized Multi-Agent Policy Gradients": IEEE Transactions on Emerging Topics in Computational Intelligence, 2023.
- Yongsheng Mei, **Hanhan Zhou**, Tian Lan, Guru Venkataramani, and Peng Wei, "MAC-PO: Multi-agent Experience Replay via Regret Minimization": Accepted at the Int. Conf. Auton. Agents & MultiAgent Syst (AAMAS) 2023.
- **Hanhan Zhou**, Tian Lan, and Vaneet Aggarwal, "Statistically Efficient Variance Reduction with Double Policy Estimation for Off-Policy Evaluation in Sequence-Modeled Reinforcement Learning": Accepted at FMDM-NeurIPS, 2023.
- Chang-Lin Chen, **Hanhan Zhou**, Jiayu Chen et al. "Two-tiered Online Optimization of Region-wide Datacenter Resource Allocation via Deep Reinforcement Learning": arXiv preprint, 2023.
- **Hanhan Zhou**, Tian Lan, and Vaneet Aggarwal, "PAC: Assisted Value Factorisation with Counterfactual Predictions in Multi-Agent Reinforcement Learning": Accepted at Conference on Neural Information Processing Systems (NeurIPS), 2022.
- **Hanhan Zhou**, Tian Lan, Guru Venkataramani, Wenbo Ding, "On the Convergence of Training Heterogeneous Models with Online Pruning in Federated Learning": Accepted at FL -NeurIPS, 2022
- **Hanhan Zhou**, Tian Lan, Guru Venkataramani, "PT-VTON: an Image-Based Virtual Try-On Network with Progressive Pose Attention Transfer": Computing Research Repository (CoRR), 2021
- **Hanhan Zhou**, Tian Lan, Guru Venkataramani, "Hunting Garbage Collection Related Concurrency Bugs through Critical Condition Restoration": In Proceedings of the 2020 ACM CCS Workshop on Forming an Ecosystem Around Software Transformation (FEAST), 2020

Research and Industrial Experience

- **Graduate Research Assistant** — Washington, DC
  Lab for Intelligent Networking and Computing, advised by Prof. Tian Lan, GW — *Jun 2019 - Present*
  - **Research Topic 1: Multi-Agent Reinforcement Learning** Proposed a framework using deep variational information bottleneck method as assisted information aiding global value function factorization in multi-agent reinforcement learning. Evaluated the proposed method on the StarCraft II challenge and demonstrated a substantial performance improvement over the state-of-the-art algorithms by over 10% and several works are published in NeurIPS and AAMAS.
  - **Research Topic 2: Optimizations in Distributed Learning** Proposed an optimization algorithm and conducted convergence analysis on Federated Learning with heterogeneous local clients. Validated the proposed theory on several datasets and provided remarks on designing algorithms of heterogeneous federated learning. Several works have been accepted at conferences like FL-NeurIPS 2022 for oral presentation and NeurIPS 2023.

- **Research Topic 3: Cyber and Software Security** Conducted software security testing using AFL-based fuzzing tools on communication protocols like SSL and proposed a machine-learning-based privacy-preserving app for Android using the Xposed framework. Studied the occurrence of concurrent bugs in JavaScript inside the WebKit engine, and proposed a framework that generates critical conditions to promote the reproduction of concurrency-related bugs within limited execution overhead, the work is accepted at CCS FEAST 2020.

- **App Development Intern - Full Stack** New York, NY
  AdviceCoach LLC *Jun 2018 - August 2018*
  - Designed and developed a mobile-friendly website using React.js and Redux, allowing users to edit and create playbooks on their mobile phones' browser before installing the app.
  - Implemented REST APIs, which allows the frontend to interact with the backend server, for customizing the playbook, sending messages to other customers and receiving feedback, etc.
  - Tested app with the latest version, debugged and improved user experience based on users' feedback.
- **Software Engineer Intern - Embedded Systems & Design** Hangzhou, China
  Lanxum Gushenxing NetSec Inc. *Dec 2016 - Mar 2017*
  - Worked in a group of six software engineers responsible for designing and testing industrial RTU (Remote Terminal Unit) and ZigBee Modules.
  - Implemented customized models of industrial firewalls like anti-sniffing, and enhanced whitelist (using snort etc.) based on clients' requirements.
  - Designed preset safe configuration rules on a Node.js based monitoring portal Website.
  - Performed safety check for clients' network robustness and security with GE Achilles

Selected Development Projects

- **Weekend: A Event Search and Ticket Recommendation with fine-tuned LLM-based ChatBot** for personalized nearby using Java Web Service Development
  - Improved personalized recommendation based on search history and favorite records.
  - Applied Elastic stack (**Elastic Search, Logstash, Kibana**) for user profiling and further analysis.

  Back End:
  - Created Java servlets with **RESTful** APIs to handle HTTP requests and responses.
  - Built NoSQL databases (**MongoDB**) to capture real business data from TicketmasterAPI and store user data.
  - Embeded a few-shot fine-tuned **LLM**-based chatbot using Vertex AI and Gradio for events recommendation.
  - Deployed the server to **AWS EC2**, which can handle 260 queries per second tested by **Apache JMeter**.

  Front End:
  - Developed an interactive web page for users to search events and purchase tickets based on their geo-location with **AJAX** and **JavaScript**.
- **Circa: A Geo-indexed Based Social Network WebApp** with Image Recognition & Stable-Diffusion based Generation and NLP based content analysis

  Front End:
  - Built a geo-based social network web app with **React** JS which can display and upload images and videos.
  - Implemented a token-based registration, login/logout and post flow with **React Router v4** and server-side user authentication with **JSON Web Token**s.
  - Implemented features like "Create Post", "Nearby Posts as Gallery" and "Nearby Posts in Map" with **Material UI** Design, **GeoLocation API** and **Google Map API**

  Back End:
  - Built a scalable web service in **Golang** to handle requests and deployed to Cloud (Google App Engine flex).
  - Utilized **ElasticSearch** (on Google Compute Engine) to provide geolocation-based search functions so that users can search nearby posts within a certain distance (e.g. 100 miles).
  - Used **Google Dataflow** to implement a daily dump of posts to BigQuery table for offline analysis.
  - Applied a keyword-based spam detection using **BigQuery** on data at the post level and user level.
  - Trained a face detection model using **Cloud ML** API and **Tensorflow** and integrated with the **Golang** service
- **AliDada: A Deep Reinforcement Learning-based Recommendation System** with Spring and Hibernate-backed online Shopping WebApp
  - Used Spring framework to build a web application for online shopping.
  - Built a web application based on Spring **MVC** (dependency injection, inversion of control, REST API etc.) to support item searching dataflow
  - Implemented **recommendation system** by training an **reinforcement learning** agent under soft-actor-critic algorithm.
  - Used Spring Security to implement **OAuth2.0** based authentication.
  - Utilized **Hibernate** to provide better support of database operations.
  - Developed a Spring Web Flow to handle item order confirmation and checkout flow.
  - Integrated an ad bidding system based on second highest bid to deliver ads on the website.

Selected Honors and Awards

- NeurIPS Scholar Award - 2022
- Runner Up Prize at GW New Venture Competition - 2021
- Lin Weng Graduate Scholarship - 2021
- Facebook Research Scholarship - 2019
- GW SEAS Graduate Ambassador, 2019