Curriculum Vitae/Resume

Jincheng Zhou

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EDUCATION

University of Southern California **Los Angeles, CA**

- Master of Science in Computer Science (in progress) Aug 21 – May 22
  - Related Coursework (2021 Fall Semester): **Applied Natural Language Processing**
  - Prospective Coursework (2022 Spring Semester): **Affective Computing**, **Multimodal Probabilistic Learning of Human Communication**

University of Southern California **Los Angeles, CA**

- Bachelor of Science in Computer Science, **GPA: 3.96/4.00** Aug 17 – May 21
  - Graduated with **Computer Science Outstanding Student Award** (Top 10 students in CS Dept.)
  - Related Coursework: Introduction to Artificial Intelligence, Deep Learning and its Applications, Theory of Computing, Software Engineering
- Bachelor of Science in Mathematics, **GPA: 3.96/4.00** Aug 17 – May 21
  - Related Coursework: Mathematics of Machine Learning, Probability Theory, Mathematical Statistics, Analysis, Advanced Topics in Linear Algebra, Geometry and Transformations, Number Theory, Applied Combinatorics, Abstract Algebra, Numerical Methods

STANDARDIZED TEST SCORES

- **GRE: 331** – Verbal: 162, Quantitative: 169, Writing: 4.5
- **TOEFL: 112** – Reading: 30, Listening: 30, Speaking: 24, Writing: 28

RESEARCH INTERESTS

- Artificial General Intelligence, Cognitive Architectures, Cognitive Modelling, Deep & Multi-Agent Reinforcement Learning, Probabilistic Graphical Models & Programming, Knowledge Representation & Representation Learning, Causal Inference & Discovery, Natural language Processing.

PUBLICATIONS

[1] **Jincheng Zhou**, Volkan Ustun. *PySigma: Towards Enhanced Grand Unification for the Sigma Cognitive Architecture.* In Proceedings of the 14th Conference of Artificial General Intelligence, Oct 2021 (in press). URL: https://drive.google.com/file/d/1_92D9WhAJXK4Gjx2J6yCUZffxJcAblBl/view?usp=sharing

[2] Yunzhe Wang, Nikolos Gurney, **Jincheng Zhou**, David V. Pynadath, Volkan Ustun. *Route Optimization in Service of a Search and Rescue Artificial Social Intelligence Agent.* In Proceedings of the AAAI 2021 Fall Symposium Series: Computational Theory of Mind for Human-Machine Teams Workshop, Sep 2021 (in press). URL: https://drive.google.com/file/d/1SvstZZz8axwi-rcZfaqiHPXcHvlJlGmH/view?usp=sharing

TALKS & PRESENTATIONS

- *PySigma: Towards Enhanced Grand Unification for the Sigma Cognitive Architecture.* Technical presentation at the 14th Conference of Artificial General Intelligence. Sunday, Oct 17, 2021. URL: https://youtu.be/evXLHTFTgxQ

RESEARCH EXPERIENCE & PROJECTS

Student Worker/Research Assistant at the USC Institute for Creative Technologies Jan 20 – Current

PySigma: Towards Enhanced Grand Unification for the Sigma Cognitive Architecture

Supervisor/Mentor: **Prof. Paul Rosenbloom** and **Dr. Volkan Ustun**

- Redesigned the entire computational layer (the graphical layer) of the Sigma Cognitive Architecture.
- Conducted a comprehensive literature review on message-passing inference algorithms for probabilistic graphical models.
- Enabled probabilistic logical predicates to encode arbitrary probabilistic distributions and created new message structures to represent such predicates.

- Conceived a generalized message-passing algorithm combining *Variational Message Passing (VMP)* and *Monte Carlo Message Passing (MCMP)* for continuous approximate inference in lifted factor graphs.
- Analyzed the methematical correctness of the said message design and generalized algorithm.
- Implemented the entire *PySigma* architecture from the ground up in Python using PyTorch while strictly following software engineering best practices such as comprehensive unit testing and documentation.

Student Worker/Research Assistant at the USC Institute for Creative Technologies Jan 20 – Current
Route Optimization in Service of a Search and Rescue Artificial Social Intelligence Agent
Supervisor/Mentor: **Prof. Paul Rosenbloom** and **Dr. Volkan Ustun**

- Investigated various *Graph Transformer* models for efficiently and approximately solving route optimization problems such as *Travelling Salesman Problem (TSP)* and *Capacitated Vehicle Routing Problem (CVRP)*.
- Designed a *Coorperative Mutli-Agent Reinforcement Learning* system where agents with different roles and capabilities use the said *Graph Transformer* models as the oracle to get approximately optimal paths and coorperate to solve a Search-and-Rescue task in a Minecraft environment.
- Constructed an efficient data preprocessing pipeline for the Message-bus of the Search and Rescue Testbed.
- Streamlined the experimentation workflow by integrating the codebase with *Data Version Control (DVC)* for version-controlling experiments and *WandB* for real-time logging of the experiment statistics.

Undergrad Researcher at the USC Cognitive Learning for Vision and Robotics lab Aug 19 – Nov 19
Generalizing Reinforcement Learning to Unseen Actions
Supervisor/Mentor: **Prof. Joseph Lim**

- Conceptualized and designed a variety of new tasks with vastly different properties for a novel RL benchmark environment.
- Conducted large-scale experiments studying the capability of various RL algorithms to generalize to unseen actions in the novel RL benchmark.
- Designed and built a dynamic webpage frontend for interactively showcasing the project.

Research Internship at the USC Institute for Creative Technologies May 19 – Aug 19
Neural Learning of First-Order Probabilistic Logics in the Sigma Cognitive Architecture
Supervisor/Mentor: **Prof. Paul Rosenbloom** and **Dr. Volkan Ustun**

- Conducted a comprehensive literature review on neural approaches to learning first-order probabilistic logic.
- Enhanced the model proposed by *Neural Logic Machines (NLM)* in principled ways and adapted the model in the Sigma Cognitive Architecture.
- Conducted experiments at various scales and analyzed the pros and cons of the Sigma implementation of the *NLM* model.

Project Leader, Course Project for CSCI 599: Deep Learning and Its Applications Jan 19 – May 19
Learn and Exploit Causality for Curiosity-Driven Deep Reinforcement Learning
Supervisor/Mentor: **Prof. Joseph Lim**

- Conducted a comprehensive literature review on curiosity / intrinsic motivation in reinforcement learning.
- Conceptualized and formalized the notion of causally inspired intrinsic motivation expressed by causal uncertainty.
- Developed a model-based reinforcement learning algorithm that learns a *Structured Causal Model (SCM)* of its environment and uses the model's causal uncertainty to guide the agent's exploration in the environment.

Undergrad Researcher at the USC Institute for Creative Technologies Jan 19 – May 19
Deep Reinforcement Learning in the Sigma Cognitive Architecture
Supervisor/Mentor: **Prof. Paul Rosenbloom and Dr. Volkan Ustun**

- Compared and analyzed the performance of state-of-the-art RL algorithms under OpenAI Gym game environments.
- Implemented selected RL algorithms using Sigma Cognitive Architecture in Lisp and evaluated their performance.
- Extended Sigma's architectural capabilities in reinforcement learning, constructed infrastructure for building and benchmarking Sigma's RL implementations, and evaluated the architectural benefits of Sigma for reinforcement learning.

Undergrad Researcher at the USC Institute for Creative Technologies
Social Simulation of Human Behaviors Sep 18 – Dec 18

Supervisor/Mentor: **Prof. David Pynadath**

- Analyzed pan-African socio-economic survey data from Afrobarometer
- Applied statistical analysis and data mining techniques to identify the correlations between people's actions and beliefs and uncover the underlying social dynamics within certain African communities
- Built *Partial Observable Markov Decision Process (POMDP)* agent models using *PsychSim* to simulate and reflect people's social behaviors and thought processes
- Devised a theoretical method to automate the construction of such a model on general public survey data

Other Selected Projects:

Project Leader, Computer Science Major Capstone Project Feb 21 – May 21
LADA Open Discovery Toolkit LDD Genie

- Designed and implemented a full-stack open-sourced software to tag document boundaries and classify legal document types for the Los Angeles County District Attorney's Office
- Led the project team as the Person-of-Contact responsible for communicating with the stakeholders from the LADA Office and executing and maintaining the Agile software development pattern
- Built and tested a machine-learning model that automatically detects document boundaries and classifies document types, and integrated the model into the software to suggest solutions to user

AWARDS & HONORS

- **Computer Science Outstanding Student Award, USC Viterbi School of Engineering** May 21
  (Top 10 students in the CS Department)
- **USC Viterbi Dean's List** Dec 19
- **USC Dornsife Dean's List** Dec 19
- **USC Academic Achievement Award** Dec 19
- **USC Dornsife Dean's List** Dec 18
- **USC Academic Achievement Award** Dec 18
- **USC Dornsife Dean's List** May 18
- **USC Academic Achievement Award** May 18

TEACHING EXPERIENCE

- **Course Producer**(Undergrad TA) for CSCI 170: Discrete Methods in Computer Science Aug 18– Dec 18
- **Course Producer**(Undergrad TA) for CSCI 270: Introduction to Algorithms & Theory of Computing Jan 19–May 19
- **Course Producer**(Undergrad TA) for CSCI 270: Introduction to Algorithms & Theory of Computing Aug 19–Dec 19

SKILLS

- Programming languages: Python, Common Lisp, Julia, C++, Java, C#, JavaScript/TypeScript, HTML/CSS, SQL, SPARQL
- Packages: NumPy, Pandas, sklearn, PyTorch, TensorFlow, JAX