

# Xuan Wang

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<https://xuan-wang-summer.github.io/xuanwang.github.io/>

## Education

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### University of California, San Diego

**GPA: 4.0 / 4.0**

*Ph.D.* in Computer Science and Engineering

*Expected 2027*

Advisor: Prof. Tajana Rosing

### University of California, San Diego (Double Major) (Cum Laude)

**GPA: 3.857 / 4.0**

*B.S* in Computer Engineering (Major GPA: 3.894 / 4.0)

*Jun. 2023*

*B.S* in Applied Mathematics (Major GPA: 3.976 / 4.0)

*Jun. 2023*

## Publication

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- **Xuan Wang**, Minxuan Zhou, Tajana Rosing, “**Fast-OverlaPIM**: A Fast Overlap-driven Mapping Framework for Processing In-Memory Neural Network Acceleration”, *in submission*.
- Behnam Khaleghi, Xiaofan Yu, Jaeyoung Kang, **Xuan Wang**, Tajana Rosing, “Private and Efficient Learning at the Edge with Hyperdimensional Computing”, *in submission*.
- Minxuan Zhou\*, **Xuan Wang\***, Tajana Rosing, “**OverlaPIM**: Overlap Optimization for Processing In-Memory Neural Network Acceleration”, *Design, Automation, and Test in Europe (DATE '2023)*.

\* *Co-first authors.*

## Research Projects

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### Domain-Specific Acceleration with Fully Homomorphic Encryption

*Oct. 2023- Present*

*SEE Lab, UC San Diego (Advisor: Prof. Tajana Simunic Rosing)*

- Investigating fully homomorphic encryption for domain-specific hardware acceleration.

### OverlaPIM: Overlap Optimization for PIM NN Acceleration

*SEE Lab, UC San Diego (Advisor: Prof. Tajana Simunic Rosing)*

*Apr. 2021- Present*

- Developed **OverlaPIM**, a DNN mapping framework on PIM, produced **2.10x to 4.11x** faster mappings through input-output computational overlap and transformation in C++ with baseline Timeloop.
- Optimized framework to evaluate whole DNN model in design space instead of a single layer.
- Achieved up to **24.45x** speedup by designing and implementing priority-based search algorithm for **OverlaPIM-Fast**.
- Proposed fine-grained analytical overlap analysis algorithm to achieve **3.38x to 323.11x** runtime speedup.
- Co-designed between architecture constrains and framework to generate better mapping in **OverlaPIM(-Fast)**.
- Implemented a toolkit in Python to generate architecture and mapping constrains for NN acceleration analysis.

### Private Hyperdimensional Computing

*SEE Lab, UC San Diego (Advisor: Prof. Tajana Simunic Rosing)*

*May. 2023- Sept. 2023*

- Experimented non-private and private training and inference attack for HD computing on MINIST, CIFAR10 and CIFAR100 using ResNet50.
- Evaluated the per-stage decoding time and evaluated the per epoch training time on CPU and GPU.

### Genomics Pairwise Sequence Alignment Acceleration

*Turakhia Lab, UC San Diego (Advisor: Prof. Yatish Turakhia)*

*Apr.2022 - Sept.2022*

- Implemented PEs and SRAMs ASIC design for genomics pairwise sequence alignment acceleration in System Verilog.
- Collected ALUTs resources, registers, and Fmax data by synthesizing on Vivado.

### **BASEDNet: Baseline Detection for Historical Documents**

Berg Lab, UC San Diego (Advisor: Prof. Taylor Berg-Kirkpatrick)

*Oct. 2020 – Jun. 2021*

- 1 of 49 students chosen for CSE Early Research Scholars Program and earned the highest grade out of 14 research groups on group research proposal.
- Optimized historical document transcription quality using of convolution network and gradient search algorithm.
- Implemented BASEDNet, a DNN model in Tensorflow and evaluated using the IoU formula.
- Achieved **97%** accuracy in baseline scoring with BASEDNet + dhSegment.

### **Technical Skills/Selected Coursework**

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- **Technical Language:** C++, Python, C, System Verilog, Java, Julia, SageMath, Markdown ARM assembly, HTML.
- **Tools and Skills:** OpenGL, Cuda, PyTorch, MATLAB, Vivado, LTspice, LaTeX, Unix/Linux, Git, VS Code, Visual Studio, Bash, GitHub, TensorFlow, Docker, NumPy, Jupyter Notebook.
- **CS Coursework:** Computer Architecture, Parallel Computing, Operating System, Fully Homomorphic Encryption, Digital System Design, Circuit Design, Artificial Intelligence, Data Mining, Data Structure, Algorithm, Prob & Stats, Signal & System.
- **Mathematics Coursework:** Linear & Nonlinear Optimization, Graph Theory, Combinatorics, Geometric Computer Graphics, Real Analysis, Advanced Linear Algebra, Calculus.

### **Selected Projects**

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#### **Heart Rate Prediction, UC San Diego**

*Dec. 2022*

- Trained a model for heart rate prediction and achieved 90.14% accuracy by testing different feature usages in PyTorch.
- Analyzed and visualized the given dataset in Python and composed a report.

#### **Trotting Horse Lamp, UC San Diego**

*Dec. 2022*

- Animated an OpenGL scene for trotting horse lamp in C++.
- Implemented keyboard controls to allow mode changes of the scene.

#### **SHA256 and Bitcoin, UC San Diego**

*Mar. 2022*

- Implemented SHA256 and Bitcoin cryptography algorithm in System Verilog.
- Optimized the system using parallel processing and bit reducing strategies.

#### **Information Theory and Game Wordle, UC San Diego**

*Mar. 2022*

- Introduced Information Theory, Entropy, and Game Wordle in Python with mathematical proof and reasoning.
- Implemented Information Theory and Entropy to solve the Game Wordle automatically in Julia.

### **Honors and Awards**

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- **TRELS** (Triton Research & Experimental Learning Scholars) Quarterly Awards (WI23)
- **Tau Beta Pi** Engineering Honor Society (2021-present)
- Thurgood Marshall College Honor Program (2021-2023)
- **Provost Honors:** FA19, WI20, SP20, WI21, SP21, FA21, WI22, SP22.
- Provincial Second Prize in National Chemistry Olympiad (2018).