Michael Cruz, M.S.

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SUMMARY

Technical professional with extensive experience in full-stack development. Proficient in multiple programming languages including but not limited to C++, C#, Python, MATLAB, and JavaScript, to develop scalable applications, mobile games, and probabilistic models. Adroit in using advanced techniques in AI, computer vision, and natural language processing to solve complex optimization problems and train state of the art models. Dedicated to research, design, debugging, and documentation of software, complying with product specifications throughout the production life cycle. Adept at collaborating in cross-functional teams and automating workflows to enhance operational efficiency. Committed to leveraging deep technical skills to deliver robust, secure, and innovative software solutions in dynamic environments.

SKILLS

- **Languages:** Python, C++, C, C#, Java, JavaScript, HTML5, PHP, CSS, jQuery, AJAX, MIPS
- **Frameworks & Tools:** Visual Studio, Git, TensorFlow, PyTorch, Matplotlib, Scikit-learn, LangChain, LangSmith, LangGraph, n8n, MATLAB, React.js, Node.js, Next.js, Typescript, Tailwind, SLURM, Flask, FastAPI, Android Studio, .NET, Accela, Crystal Reports, Agile, Scrum
- **Specialties:** Deep Learning, Machine Learning, Computer Vision, 3D Computer Vision, NLP, Artificial Intelligence, Reinforcement Learning, Generative Modeling, RAG, Data analysis, ETL pipelines, Full Stack Development, Network Security, Network Architecture
- **Platforms:** Linux, Kali Linux, Virtual Machines, Windows, MacOS, Android, iOS
- **Database Management:** Toad SQL Server, SQLite, SQLite3, MySQL, Firebase, MongoDB, DynamoDB, Vector Databases, Vector Stores, Data Lakes
- **DevOps/Cloud Infrastructure:** AWS, Azure, Docker, Kubernetes, Jira, clickup, GitHub, CI/CD, AWS Lambda, S3, SageMaker, Google Cloud, Lindoe, Vercel

EDUCATION

Orlando, FL   University of Central Florida   Aug 2022 – Dec 2024
- **Master of Science in Computer Science**
- Relevant Courses: Machine Learning, 3D Computer Vision, Computer Vision, Natural Language Processing, Artificial Intelligence and Agents, Advanced Data Structures and Algorithms, Linear Algebra, and Computer Architecture
- Research: Large language models, multi-modal vision language models, AI agents, hardware optimization

Tallahassee, FL   Florida State University   Aug 2015 – Dec 2021
- **Bachelor of Science in Computer Science**
- Minor: Psychology
- Relevant Courses: Computing in Python, Object-Oriented Programming, Kernel Development, Data Structures and Algorithms, Discreet Math, Software Engineering Principles, Computer Architecture, OSI Model, Concurrent and Parallel Computing

EMPLOYMENT

Application Systems Analyst   **Jan 2022 – Jan 2023**
Leon County Government, Tallahassee, FL
- Streamlined the permitting process for contractors by enhancing the Accela framework, resulting in faster approvals and improved stakeholder satisfaction
- Generated financial reports, accurately tracking millions of dollars in revenue from development activities
- Performed thorough unit testing on the Accela system, identifying key areas for improvement and ensuring seamless user experience for land development permits.
- Led the development of automating daily financial reporting tasks using C# and .NET ultimately reducing my team's daily workload by 35%
- Pioneered several new permit types leading to a 24% increase in revenue
- Conducted system migrations of legacy permits to current formats, ensuring data integrity and compliance with current permit standards.
- **Knowledge Leveraged**: .Net, C#, JavaScript, SQL, Excel, Azure, ArcGIS, Accela, Crystal Reports, APIs

Level II Agent   **June 2020 – Nov 2020**
Department of Children and Families, Tallahassee, FL
- Assisted clients with navigating financial assistance and welfare programs during the COVID-19 crisis.
- Managed high call volumes and provided timely solutions under tight deadlines, maintaining a customer satisfaction rate of 94%.

PROJECTS

WebPsych
- The WebMD for mental health and psychological disorders created to help individuals identify possible mental health disorders they could be suffering from
- The DSM-V is used in a RAG pipeline to classify user input symptoms into possible mental disorders matching those systems
- First the user input is used in a template prompt to the LLM to analyze and summarize physical symptoms identified by the user
- The output is then used in another QA template prompt to find candidate documents using cosine similarity search to determine what mental disorder, if any, could be the cause of the user's symptoms
- The RAG pipeline is an API with a fastAPI docker container that interacts with a React.js frontend

End-to-End Deep Learning: Building a Transformer from Scratch
- Implementation of the paper Attention is All You Need from scratch using the specified architecture from the original experiment with hardware and task specific learning configurations.
- The Transformer was trained for language translation from English to Spanish.
- Hyperparameters of the model architecture are similar to the specifications of the paper.
- Dataset: opus books en-es 93k

Building an Efficient Facial Detection System
- Implemented six facial detection algorithms: Haars Cascade, MTCNN, Dlib, DNN, RetinaFace, and HOG to determine the optimal algorithm for an automatic door lock utilizing biometric data for the locking mechanism
- Each algorithm was tested on three mediums: image, video, and live stream
- Bounding box coordinates are given for all detected faces in each sample
- Each bounding box is projected back onto the sample and compared to the original to determine precision, accuracy, and time measures

- The positive predictive value (PPT) is computed for each algorithm to determine which algorithm is optimal for various situations and mediums

Stereo 3D Reconstruction
- Designed a Stereo 3D Reconstruction via linear triangulation system using MATLAB that reconstructs 2D objects into 3D renderings given two images of the object from different camera views.
- Using RANSAC, inliers of matching image points are detected to estimate the fundamental matrix between the scenes
- The camera project matrix is constructed for each image using the fundamental matrix, camera intrinsic parameters, and the set of matching points
- Each 2D coordinate is linearly triangulated to its 3D location and stored in a point cloud model for rendering

Image Stitching with Homography-Based Panoramas
- Created a panorama generation program using MATLAB that constructs image mosaics by computing the infinite homographies between sequences of images and stitching the warped images onto a canvas.
- RANSAC is used to detect matching image points to construct point correspondence matrices
- The infinite homography between each adjacent pair of images is computed by finding the null space of the point correspondence matrix associated with the images
- The homographies are used to warp and stitch the images onto the panorama

Generative Clinical Report model using Federated Learning
- Designed a novel approach to automate clinical report generation from medical imaging data within a federated learning framework, addressing data privacy concerns (HIPAA) while enabling collaborative model training across multiple institutions
- Each independent client model utilized an encoder-decoder network which included a fine-tuned ResNet152 CNN encoder and an LSTM RNN decoder
- The model was trained on the UI X-Ray dataset consisting of Chest X-Rays and accompanying medical reports
- The federated learning (FedAvg) architecture was implemented, where multiple client models (representing individual medical facilities) were trained independently on their respective subsets of data. Their trained layer weights were then sent to a global model, averaged, and propagated back to each client
- Successfully implemented a federated learning setup using the FedAvg architecture, demonstrating a methodology for training medical models while upholding HIPAA laws and protecting patient confidentiality.

Egocentric Large Video Language Model
- Engineered a method to fine-tune Vid-LLMs on egocentric (first-person perspective) video content to address the limitations of models primarily trained on third-person perspectives.
- Benchmarked SOTA models on the EgoSchema dataset and selected Video-LLaVA for its superior zero-shot capabilities on egocentric Video QA tasks
- Fine-tuned Video-LLaVA on the Ego4D dataset using custom annotations using prompt engineering/tuning
- Successfully improved performance of Video-LLaVA compared to all other SOTA models

More projects and research in portfolio linked above