IVAN ERIC DÍAZ ARENAS

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EDUCATION (DOUBLE DEGREE PROGRAM)

Instituto Tecnológico de Monterrey (Tec de Monterrey)- Monterrey, Mexico - 2018 to June 2024

- *B.S. Mechatronics Engineering* with tuition scholarship of *Mario J. Montemayor Association*. Overall grade: 89.7/100

Hochschule für Technik und Wirtschaft des Saarlandes (HTW Saar)- Saarbrücken, Germany - 2021 to 2024

- *B.S. Mechatronics/Sensor Technology*. Overall grade: 2.1 ECTS

Relevant Coursework: Software Development for Collaborative Industrial Robots, Process Automation, Industrial Robotics, Automation of Manufacturing Systems, Integral Automatic Control Laboratory.

WORK EXPERIENCE

Evocortex GmbH - Machine Learning Department - Nuremberg, Germany - April 2022 to April 2024

Undergraduate thesis (score 1,3 in European Credit Transfer):

- Title: *Object Detection System Implementation for an Autonomous Mobile Robot using a Synthetic 2D-RGB Data Generation Approach.*
- Problem (dataset shift): training with purely synthetic data (computer rendered images) significantly reduced the object detection rate in real world industrial scenarios (initial tests obtained a mean average precision (mAP) lower than 50%).
- Contribution: strategy based on the domain randomization with an improvement on the detection task that achieved an mAP slightly over 60% on real-world scenarios.

Working student (thesis work continuation):

- **Custom saliency maps implementation for visual explanations of a convolutional networks's focus point during the object detection task:** developed a method following a gradient-based algorithm and implemented an agnostic one, both to improve the synthetic data strategy and obtain a higher mAP during the detection task.
- **Evaluation of Generative Adversarial Networks and Diffusion Models for synthetic image generation in industrial scenarios.**
- **Pipeline implementation for synthetic data generation using Stable Diffusion (SD) and ControlNet neural network structure:** developed for custom objects found on industrial scenarios making it easier to generate datasets ready for training.

MOST RELEVANT PROJECTS

VantTec (Autonomous Vehicles Team) - Monterrey, Mexico - Since april 2022

Underwater Computer Vision:

- **Color recovery of lost colors and removal of the back-scattering effect, employing the underwater image formation model:** Review of mathematical concepts and implementation of a python script based on the sea-thru model.
- **Review of Visual SLAM for underwater applications using 3d Gaussian Splats and Neural Radiance Fields.**
- **ControlNet-based NN structure specialized in underwater applications** (in progress): diffusion models do not consider the underwater image formation model when rendering images in underwater applications. Trying to condition the diffusion process with the mathematical coefficients coming from the underwater imagery enhancement.

Software:

- **Underwater robotics simulation**: incorporated the unmanned underwater vehicle (UUV) to an underwater world, containing plugins for thrusters, hydrostatic forces and camera's visual distortions. Main Tools: Robotic Operating System (ROS 1) and Gazebo.
- **Manipulation of UUV's sensors**: Barometer, IMU and ZED Camera with its respective ROS nodes.
- **LLM module for autonomous navigation and touristic information** (in progress). For campus tours at Tec de Monterrey, added to an existing autonomous vehicle using Retrieval Augmented Generation (RAG). Main tools: Langchain and ChromaDB.

PUBLISHED PAPERS

- 2022 IEEE Global Engineering Education Conference (EDUCON): *A Digital Twin implementation for Mobile and collaborative robot scenarios for teaching robotics based on Robot Operating System*.
- 2024 Education Sciences: *Disciplinary Competencies Overview of the First Cohorts of Undergraduate Students in the Biotechnology Engineering Program under the Tec 21 Model*.

SKILLS

Python, Pytorch, Robotic Operating System, Docker, Blender, Solidworks, Ubuntu/Linux, TIA Portal, Gazebo Simulator, Isaac Sim, OpenCV, Git, GIMP, Pandas, Streamlit, Chromadb, Langchain, Spanish (native), English (iBT 106/120), German (Goethe B2), ZED, RealSense, YOLO