IVAN ERIC DÍAZ ARENAS

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SUMMARY

Mechatronics engineer with a strong interest on machine learning algorithms within the robotics field. Working experience at a german robotics startup and research experience on a mexican autonomous vehicles team.
Check my latests projects and refer to more information: https://ivan5d.github.io/ivan_diaz.github.io/

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 reduces the object detection rate in real world industrial scenarios (initial tests obtained a mean average precision lower than 50%).
- Contribution: following the domain randomization approach, the performance of neural networks during the detection task achieved an mAP slightly over 60% on real-world scenarios.

Working student (thesis work continuation):

- Problem: synthetic data used for training still lead to key undesirable False Positives and False Negatives on real-world scenarios.
- Task 1: internal structure analysis of a YOLO-based neural network to implement saliency maps that could explain the network's focus point on the image during the detection task, following both a gradient-based-method algorithm and an agnostic one. With this information, the synthetic data strategy was constantly adapted and tested.
- Task 2: pipeline implementation for synthetic data generation using deep diffuse models based on Stable Diffusion (SD) v1.5 and ControlNet neural network (NN) structure.

PROJECTS

VantTec - Unmanned Underwater Vehicle (UUV) project - Monterrey, Mexico - July 2021 to present day

Computer vision department:

- Problem: diffuse models do not consider the mathematical underwater image formation model (attenuation coefficients) when rendering images in underwater applications.
  - Contribution: ControlNet-based NN structure specialized in underwater applications for controlling diffuse models during the image renderization. (In progress)
- Underwater image color recovery for underwater applications based on Sea-thru implementation.

Software department [work in progress]:

Update and integration of UUV's Main Repository. It is broken and full of branches.

- Underwater gazebo robotics simulation for the UUV aimed for testing the control system. It runs the UUV's ROS application and contains plugins for thrusters, sonar simulation, camera's visual distortions, among others. (In progress)

RESEARCH EXPERIENCE

Published papers - Education field - Monterrey, Mexico

- [Conference paper] 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.*
- [Article paper] 2024 Education Sciences: *Disciplinary Competencies Overview of the First Cohorts of Undergraduate Students in the Biotechnology Engineering Program under the Tec 21 Model*

EDUCATION (DOUBLE DEGREE PROGRAM)

University - Instituto Tecnológico y de Estudios Superiores de Monterrey (Tec de Monterrey)- Monterrey, Mexico - 2018 to June 2024
B.S. Mechatronics Engineering with tuition scholarship of *Mario J. Montemayor* Foundation

University - Hochschule für Technik und Wirtschaft des Saarlandes (HTW Saar)- Saarbrücken, Germany - 2021 to 2024
B.S. Mechatronik/Automatisierungstechnik with scholarship HTW Saar for international students

SKILLS

Language skills: Spanish (mother tongue), English (TOEFL PBT 583, CEFR B2), German (Goethe B2), French B2 studies

Software skills: Python, Pytorch, Robotic Operating System, Docker, Blender, Blender API, Solidworks, Ubuntu, TIA Portal, Gazebo Robotics Simulator, Isaac Sim, OpenCV, Git, GIMP, Windows, Svelte.