**Thesis abstract**

Title: Evaluation of synthetic datasets and their influence on performance metrics of DNNs

**Intro:**

Object detection, semantic segmentation, and other computer vision algorithms are being used extensively in Autonomous vehicles. More research is being done regarding this with the clear motivation of enhancing the algorithms to meet a production-ready solution. The safety aspects of the algorithm are less explored as it requires a detailed understanding and study of the CNNs related to its reliability and performance in an unprecedented situation in order to make them more safe and secure. To achieve this, we need a synthetic dataset closely representing the real world with an appropriate distribution of assets in the scene without losing the physical nature of it. To make these networks safe and secure thorough validation of various scene descriptions are necessary with respect to all possible scene scenarios. Real-world datasets acquired through ego vehicles consist of specific scene descriptions and are limited to it with no control over the dynamic and static objects. The use of synthetic data breaks this limitation. With parameters to control the objects in a scene, any real possible scene configuration can be built and validated. Hence, this study is to create the quality requirements or performance metrics required to create synthetic datasets to perfect the mockup.

**Objectives:**

* Create 3D Scene models with parameterization.
* Compare different camera models and their effects on synthetic data generation and study of similar factors to make it close to real-world images.
* Compare different render engine models used in synthetic image generation.
* Perform inference on possible scenarios with possible parameters variation mentioned above to study the effect on CNN models.

**Approach:**

A pipeline consisting of synthetic scene creation integrated with CNN is needed to answer the open questions to create the general quality requirements.

* Publicly available synthetic datasets like Virtual Kitti, Synthia, and Richter(GTA) datasets can be used to train the semantic segmentation models.
* 3D world to be created with parameter access to all the objects in a scene.
* Parameters example: weather conditions, lighting conditions, pedestrian speed.
* Images with ground truth labels are rendered with parameter variation, different camera models and render engines.
* For inference on models trained on synthetic datasets, generated synthetic images with parameter variation are used to understand the behavior of a multitude of factors like model’s behavior based on the parameters chosen.