Missouri University of Science & Technology Department of Computer Science
Spring 2022 **CS 6406: Machine Learning for Computer Vision (Sec: 101/102)**

Homework 3: CNNs and Trustworthy Vision

Instructor: *Sid Nadendla* **Due:** *May 11, 2022*

Goals and Directions:

- The main goal of this assignment is to implement CNNs using Keras and Tensorflow, and build/apply transfer learning and explainability tools.
- Comprehend the impact of hyperparameters and learn to tune them effectively.
- A template Jupyter notebook will be provided for each problem to develop your solution.
- You may obtain your compute power from Google colab, or AWS SageMaker Studio Lab.

Problem 1 Convolutional Neural Networks *25 points*

- **Convolutional Neural Network (10 points):** Build any CNN of your choice and train it on CIFAR-10 dataset. Your CNN should produce an accuracy of at least 75%.
- **Transfer Learning (10 points):** Import RESNET-50 from Keras' pretrained model library, which is originally trained on ImageNet. Use transfer learning techniques and retrain the model on CIFAR-10 dataset.
- **Comparison (5 points):** Evaluate your CNN model, and compare its performance with the re-trained RESNET-50 model in terms of accuracy and mean average precision (mAP).

Problem 2 Explainability *25 points*

- **Grad-CAM (15 points):** Demonstrate Grad-CAM for the class "horse" in your own CNN model from Problem 1.
- **TCAV (10 points):** Test a concept *cloud* in your model's ability to detect the class "airplanes". You may collect the cloud images from CIFAR-100 dataset. This enables you to understand if your model is truly learning the correct features in detecting an aircraft.