**University of Central Missouri**

**Department of Computer Science & Cybersecurity**

**CS5720 Neural Networks and Deep Learning**

**Summer 2025**

**Home Assignment 1.**

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**Submission Requirements:**

* Once finished your assignment push your source code to your repo (GitHub) and explain the work through the ReadMe file properly. Make sure you add your student info in the ReadMe file.
* Submit your GitHub link and video on BrightSpace.
* Comment your code appropriately ***IMPORTANT.***
* Make a simple video about 2 to 3 minutes which includes demonstration of your home assignment and explanation of code snippets.
* Any submission after provided deadline is considered as a late submission.

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**4.1 Questions to Answer:**

1. What patterns do you observe in the **training and validation accuracy curves**?
2. How can you use **TensorBoard to detect overfitting**?
3. What happens when you increase the number of epochs?

Ans.: **What patterns do you observe in the training and validation accuracy curves?**

* In the beginning, **both training and validation accuracy** typically increase.
* After several epochs:
  + **Training accuracy** continues to improve.
  + **Validation accuracy** may **plateau or start to decline**.
* If the gap between training and validation accuracy becomes large, this indicates **overfitting**.
* In overfitting, the model learns the training data too well and loses generalization to unseen data.

**2. How can you use TensorBoard to detect overfitting?**

* Open TensorBoard and check the **Scalars** tab.
* Look at graphs of:
  + **Training vs Validation Accuracy**
  + **Training vs Validation Loss**
* Overfitting is visible when:
  + **Training loss decreases**, but **validation loss increases**.
  + **Training accuracy increases**, but **validation accuracy stagnates or drops**.
* This gap shows the model is performing well on training data but poorly on validation data.

**3. What happens when you increase the number of epochs?**

* Initially, more epochs help the model **learn better** and improve accuracy.
* After a point, the model may start to **overfit**:
  + Training accuracy continues to rise.
  + Validation accuracy may **stop improving or decrease**.
* To prevent overfitting:
  + Use **EarlyStopping**.
  + Apply **regularization techniques** (like dropout or weight decay).
  + Use **data augmentation** to increase generalization.