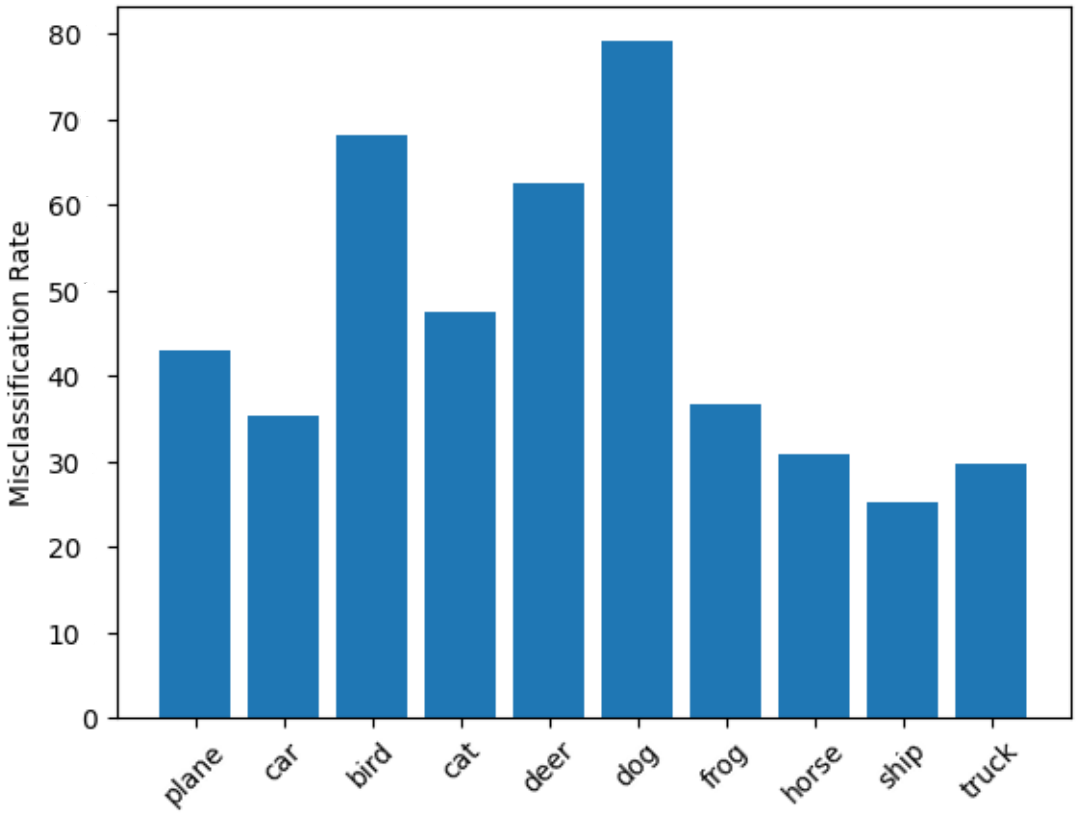
Machine Learning & Data-Mining

Assignment 10 : Applying Neural Networks

Section 1.1

1. **How well does your classification work? Plot the misclassification rate for each category onto the same plot.**

```
Accuracy for class: plane is 57.0 %
Accuracy for class: car   is 64.7 %
Accuracy for class: bird  is 31.9 %
Accuracy for class: cat   is 52.6 %
Accuracy for class: deer  is 37.6 %
Accuracy for class: dog   is 20.9 %
Accuracy for class: frog  is 63.3 %
Accuracy for class: horse is 69.3 %
Accuracy for class: ship  is 74.9 %
Accuracy for class: truck is 70.3 %
```



2. **Calculate the confusion matrix for the image classification task.**

```
[[570  27  34  25  15   0  19  23 203  84]
 [ 38 647  16   8   3   0  16  15  60 197]
 [ 96   7 319 164 119  12  83 117  43  40]
 [ 32  21  47 526  68  48  74  69  43  72]
 [ 40   8 135 117 376   2 118 157  30  17]
 [ 14  10  62 432  41 209  32 145  23  32]
 [  7  18  57 134  61   3 633  29  11  47]
 [ 15   4  35 109  39  24  14 693   9  58]
 [ 86  44   9  19   4   1   5  13 749  70]
 [ 30 137   7  22   5   0  19  23  54 703]]
```

3. **Explain what Autograd is and how it works?**

Autograd is an automatic differentiation engine used in deep learning libraries such as PyTorch and TensorFlow. It is an technique which is using automatic computation of gradients or derivatives of functions. It works by tracking operations performed on data (tensors) and by calculating the gradients. This process is important for performing gradient-based optimization algorithms like stochastic gradient descent (SGD) to update the model's parameters during training.

Section 2.1

1. **What is RNN?**

A Recurrent Neural Network (RNN) is a type of neural network architecture specifically designed for processing sequences of data. RNNs have connections that loop back on themselves which allow them to maintain a hidden state that captures information from previous time steps.

2. **Why do we use RNN when we are working with text?**

RNNs are a type of neural network that are well-suited for working with text because they can learn to model the sequential nature of language. RNNs can take text as input and provide predictions as output. This allows the RNN to learn long-range dependencies in the data, which is essential for many text processing tasks. That is make RNN useful with text.

3. **In your opinion, how well does the text generation work?**

The performance of text generation with RNNs can vary significantly depending on the model architecture, training data, and the specific task. Modern text generation models, such as those based on GPT (Generative Pre-trained Transformer) architecture, have shown remarkable capabilities in generating coherent and contextually relevant text. However, the quality of text generated can still have limitations such as text with incorrect or biased content. Overall, text generation has made significant progress and the area is still ongoing research.

4. **Name three other domains where RNNs are suitable model types for regression/classification**

- Speech recognition
- Handwriting recognition
- Face detection