Under the guidance of SHINE mentor Tejas Srinivasan, who is studying human-AI interactions, I have been learning how to create and train my own neural networks. With no prior knowledge to artificial intelligence, I had to learn from scratch. At the GLAMOR lab, research focused on AI to language connections is emphasized. The main research areas are language & perception, embodiment & action, as well as the social world.

### SHINE Research Summary

My SHINE journey consisted of starting from the basics to eventually learning how to build my own neural network from scratch. Throughout the program, I trained different kinds of machine learning models:

- **Linear Regression**
  - Predict future stock prices
- **K Nearest Neighbors**
  - Classify breast cancer tumors as either malignant or benign
- **Neural Networks**
  - Predict gender based off weight/height
- **Convolutional Neural Networks**
  - Classify images

Neural networks are made up of hidden layers which modify given inputs. These hidden layers modify the inputs by applying weights and biases.

![Neural Network Diagram](image)

To make this a functioning NN, we need to make it so that these weight and bias values change based off of our desired output. We can observe how accurate our model is based off of a loss function such as mean squared error.

\[
\text{MSE} = \frac{1}{N} \sum_{i=1}^{N} (y_i - \hat{y}_i)^2
\]

Thus, we must use a technique called backpropagation in order to observe how the weights affect loss. Basically, we write loss as a function of these variables and use partial derivatives to calculate \( \partial L / \partial w \), as well as others.

Using the Cifar-10 and Cifar-100 datasets, my project was to make a Convolutional Neural Network (CNN) to classify objects within an image. The Cifar-10 dataset has 10 classes of images (airplanes, cars, birds, cats, deer, dogs, frogs, horses, ships, and trucks), while the Cifar-100 dataset has 20 superclasses with 5 subclasses each.

<table>
<thead>
<tr>
<th>My model uses three convolutional blocks and two fully connected layers.</th>
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<tbody>
<tr>
<td>CIFAR-10 (10 classes, 79% overall accuracy)</td>
</tr>
<tr>
<td>CIFAR-100 (100 classes, 22% overall accuracy, 43% superclass accuracy)</td>
</tr>
<tr>
<td>Loss over 20 epochs</td>
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### Citations

"CIFAR-10 and CIFAR-100 datasets," Toronto.edu, 2024.

### Acknowledgements

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