

This assignment is due on **Tuesday, Nov 26 2024** at 11:59pm Beijing Time.

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## Goals

In this assignment you will practice putting together a simple image classification pipeline based on the k-Nearest Neighbor or the SVM/Softmax classifier. The goals of this assignment are as follows:

- Understand the basic **Image Classification pipeline** and the data-driven approach (train/predict stages)
- Understand the train/val/test **splits** and the use of validation data for **hyperparameter tuning**.
- Develop proficiency in writing efficient **vectorized** code with numpy
- Implement and apply a k-Nearest Neighbor (**kNN**) classifier
- Implement and apply a Multiclass Support Vector Machine (**SVM**) classifier
- Implement and apply a **Softmax** classifier
- Implement and apply a **Two layer neural network** classifier
- Understand the differences and tradeoffs between these classifiers
- Get a basic understanding of performance improvements from using **higher-level representations** as opposed to raw pixels, e.g. color histograms, Histogram of Gradient (HOG) features, etc.

## Setup

**Download.** Starter code containing jupyter notebooks will be released through piazza resource page.

**Install Packages.** Once you have the starter code, activate your environment (the one you installed in the [Software Setup](#) page) and run `pip install -r requirements.txt`.

**Download CIFAR-10.** Next, you will need to download the CIFAR-10 dataset. Run the following from the `assignment1` directory:

```
cd cs231n/datasets
./get_datasets.sh
```

**Start Jupyter Server.** After you have the CIFAR-10 data, you should start the Jupyter server from the `assignment1` directory by executing `jupyter notebook` in your terminal.

Complete each notebook, then once you are done, go to the [submission instructions](#).

## Q0: Perceptron Learning Algorithm (10 points)

The notebook **perceptron.ipynb** will walk you through implementing the perceptron algorithm.

## Q1: k-Nearest Neighbor classifier (15 points)

The notebook **knn.ipynb** will walk you through implementing the kNN classifier.

## Q2: Training a Support Vector Machine (15 points)

The notebook **svm.ipynb** will walk you through implementing the SVM classifier.

## Q3: Implement a Softmax classifier (15 points)

The notebook **softmax.ipynb** will walk you through implementing the Softmax classifier.

## Q4: Two-Layer Neural Network (15 points)

The notebook **two\_layer\_net.ipynb** will walk you through the implementation of a two-layer neural network classifier.

## Q5: Higher Level Representations: Image Features (10 points)

The notebook **features.ipynb** will examine the improvements gained by using higher-level representations as opposed to using raw pixel values.

## Submitting your work

**Important.** Please make sure that the submitted notebooks have been run and the cell outputs are visible.

Please follow the instructions on Piazza to submit your homework.