

ASSIGNMENT 4

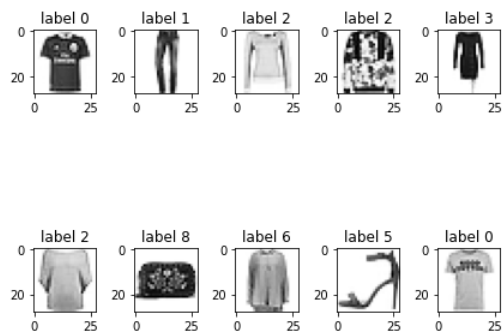
1 Question 1

1.1 Code

```
n = costing()
data = pd.read_csv('fashion-mnist_train.csv')
X, y = n.data_clean(data)
fig, ax = plt.subplots(nrows=2, ncols=5, figsize=(6,6))
labels = ["T-Shirt/Top", "Trouser", "Pullover", "Dress", "Coat", "Sandals", "Shirt", "Sneaker", "Bag"]
for i in range(10):
    x = []
    for j in range(28):
        x.append(X[i, j*28: j*28+28])
    ax[i//5][i%5].imshow(x, cmap='Greys')
    ax[i//5][i%5].set_title(labels[i])
fig.tight_layout()

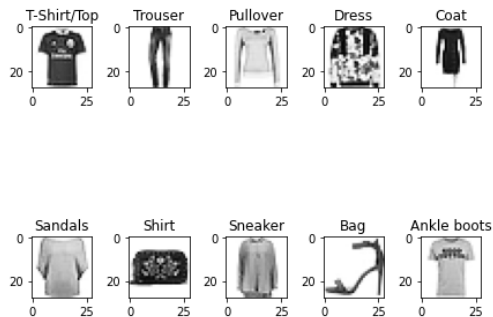
# IMPORTANT : This function is included in the class costing. So, No need to copy it.
def data_clean(self, data): # 'data' is a pandas dataframe
    y = data['label']
    data.dropna(subset=['label'], inplace=True)
    del data['label']
    self.mi = data.min()
    self.ma = data.max()
    data = (data - self.mi)/(self.ma - self.mi)
    num = 0
    X = []
    for i in data:
        X.append(data[i])
    X = np.array(X).T # Normalized 'X' (numpy array)
    # numpy array
    return X, y
```

1.2 Pictures



Code:

```
n = costing()
data = pd.read_csv('fashion-mnist_train.csv')
X, y = n.data_clean(data)
fig, ax = plt.subplots(nrows=2, ncols=5, figsize=(6,6))
labels = ["T-Shirt/Top", "Trouser", "Pullover", "Dress", "Coat", "Sandals", "Shirt", "Sneaker", "Bag", "Ankle boots"]
for i in range(10):
    x = []
    for j in range(28):
        x.append(X[i, j*28: j*28+28])
    ax[i//5][i%5].imshow(x, cmap='Greys')
    ax[i//5][i%5].set_title(labels[i])
fig.tight_layout()
```



2 Question 3

2.1 Code

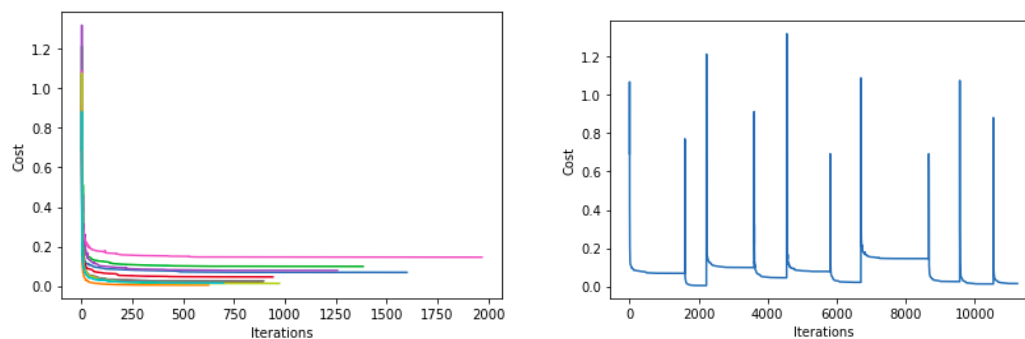
```
# Question 3 (Cost history of all labels string from same point in graph)
from matplotlib import pyplot as plt
for i in range(10):
    plt.plot(range(len(n.J_his[i])), n.J_his[i])
plt.xlabel("Iterations")
plt.ylabel("Cost")

# Question 3 continued (Cost history of consecutive labels in a line
#                               with each peak indicating its starting iteration)
x = []
for i in n.J_his:
    x.extend(i)
plt.plot(range(len(x)), x)
plt.xlabel("Iterations")
plt.ylabel("Cost")
```

2.2 Pictures

Left plot has Cost history of all labels starting from same point in graph.

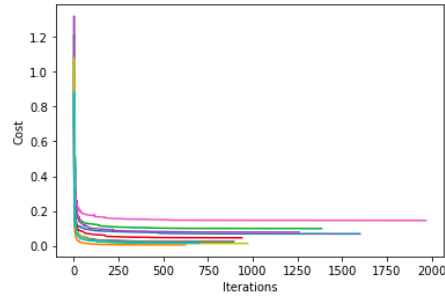
Right plot has Cost history of consecutive labels in a line with each peak indicating its starting iteration.



Code :

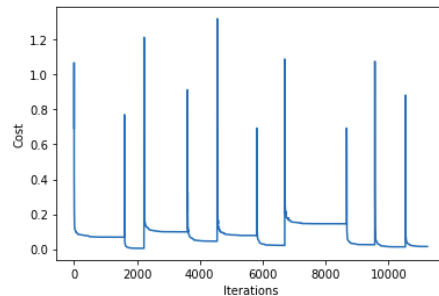
```
# Question 3 (Cost history of all labels string from same point in graph)
from matplotlib import pyplot as plt
for i in range(10):
    plt.plot(range(len(n.J_his[i])), n.J_his[i])
plt.xlabel("Iterations")
plt.ylabel("Cost")
```

Text(0, 0.5, 'Cost')



```
# Question 3 continued (Cost history of consecutive labels in a line
#                        with each peak indicating its starting iteration)
x = []
for i in n.J_his:
    x.extend(i)
plt.plot(range(len(x)), x)
plt.xlabel("Iterations")
plt.ylabel("Cost")
```

Text(0, 0.5, 'Cost')



3 Question 4

3.1 code

```
data = pd.read_csv('fashion-mnist_train.csv')
n = costing()

all_w, arcry = (n.minCostFun(data))
print("Accuracy of model for Training data :", arcry)

data = pd.read_csv('fashion-mnist_test.csv')
print("Accuracy Of model for Testing data :", n.TestingAccu(data))
```

3.2 Pictures

```
data = pd.read_csv('fashion-mnist_train.csv')
n = costing()

all_w, arcry = (n.minCostFun(data))
print("Accuracy of model for Training data :",arcry)

data = pd.read_csv('fashion-mnist_test.csv')
print("Acurracy Of model for Testing data :",n.TestingAccu(data))
```

```
Accuracy of model for Training data : 93.24
Acurracy Of model for Testing data : 86.66666666666667
```

4 Question 5

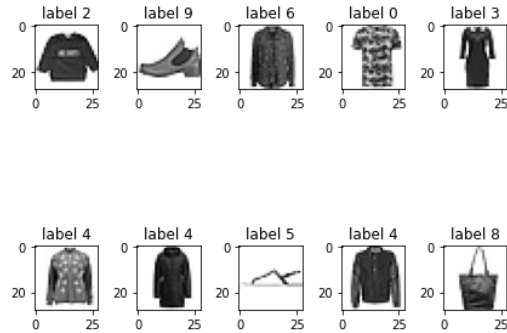
4.1 code

```
# Question 5 : plotting first 10 images in test data
data = pd.read_csv('fashion-mnist_train.csv')
n = costing()
n.minCostFun(data)
```

```
test_data = pd.read_csv('fashion-mnist_test.csv')
y = test_data['label']
test_data.dropna(subset=['label'], inplace=True)
del test_data['label']
test_data = (test_data - n.mi)/(n.ma-n.mi)
X = []
for i in data:
    X.append(test_data[i])
X = np.array(X).T
X = np.c_[np.ones(y.shape[0]), X]
labels = ["T-Shirt/Top", "Trouser", "Pullover", "Dress", "Coat", "Sandals", "Shirt", "Sneaker", "Bag"]
p = n.predictOneVsAll(n.all_w, X, n.all_w.shape[0])
```

```
fig, ax = plt.subplots(nrows=2, ncols=5, figsize=(6,6))
for i in range(10):
    x = []
    for j in range(28):
        x.append(X[i, j*28: j*28+28])
    ax[i//5][i%5].imshow(x, cmap='Greys')
    ax[i//5][i%5].set_title(labels[i])
fig.tight_layout()
```

4.2 Pictures



Code :

```
# Question 5 : plotting first 10 images in test data
data = pd.read_csv('fashion-mnist_train.csv')
n = costing()
n.minCostFun(data)

test_data = pd.read_csv('fashion-mnist_test.csv')
y = test_data['label']
test_data.dropna(subset=['label'], inplace=True)
del test_data['label']
test_data = (test_data - n.mi)/(n.ma-n.mi)
X = []
for i in data:
    X.append(test_data[i])
X = np.array(X).T
X = np.c_[np.ones(y.shape[0]), X]
labels = ["T-Shirt/Top", "Trouser", "Pullover", "Dress", "Coat", "Sandals", "Shirt", "Sneaker", "Bag", "Ankle boots"]
p = n.predictOneVsAll(n.all_w, X, n.all_w.shape[0])

fig, ax = plt.subplots(nrows=2, ncols=5, figsize=(6,6))
for i in range(10):
    x = []
    for j in range(28):
        x.append(X[i, j*28: j*28+28])
    ax[i//5][i%5].imshow(x, cmap='Greys')
    ax[i//5][i%5].set_title(labels[i])
fig.tight_layout()
```

