21MDT1056 - Priyadarshini M

Implementation of a Perceptron

Dataset in the from of a csv file contains demographics of the customer and if they clicked the ad or not . 0 means the ad was not clicked and 1 means clicked.

This data set contains the following features:

'User ID': unique identification for consumer

'Age': cutomer age in years

'Estimated Salary': Avg. Income of consumer

'Gender': Whether consumer was male or female

'Purchased': 0 or 1 indicated clicking on Ad

In [1]:
```
import numpy as np
import pandas as pd
%matplotlib inline
import matplotlib.pyplot as plt
```

In [2]:
```
class Perceptron(object):

    def __init__(self, eta=0.01, n_iter=50, random_state=1):
        self.eta = eta
        self.n_iter = n_iter
        self.random_state = random_state

    def fit(self, X, y):
        rgen = np.random.RandomState(self.random_state)
        self.w_ = rgen.normal(loc=0.0, scale=0.01, size=1 + X.shape[1])
        self.errors_ = []

        for _ in range(self.n_iter):
            errors = 0
            for xi, target in zip(X, y):
                update = self.eta * (target - self.predict(xi))
                self.w_[1:] += update * xi
                self.w_[0] += update
                errors += int(update != 0.0)
            self.errors_.append(errors)
        return self

    def net_input(self, X):
        z = np.dot(X, self.w_[1:]) + self.w_[0]
        return z

    def predict(self, X):
        return np.where(self.net_input(X) >= 0.0, 1, -1)
```

In [3]:
```
import pandas as pd

data = pd.read_csv(r"Social_Network_Ads.csv")
print("The columns are",data.columns)
data = data.sort_values(by = ['Purchased']).reset_index(drop = True)
data
```

```
The columns are Index(['User ID', 'Gender', 'Age', 'EstimatedSalary', 'Purchased
'], dtype='object')
```

Out[3]:

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15685576	Male	26	16000	0
2	15774727	Female	31	71000	0
3	15603319	Male	33	43000	0
4	15759066	Female	33	60000	0
...	...	...	...	...	...
395	15609669	Female	59	88000	1
396	15750447	Male	37	70000	1
397	15663249	Female	52	21000	1
398	15692819	Female	57	26000	1
399	15594041	Female	49	36000	1

400 rows × 5 columns

In [4]:
```
data.isnull().sum()
```

Out[4]:
```
User ID            0
Gender             0
Age                0
EstimatedSalary    0
Purchased          0
dtype: int64
```

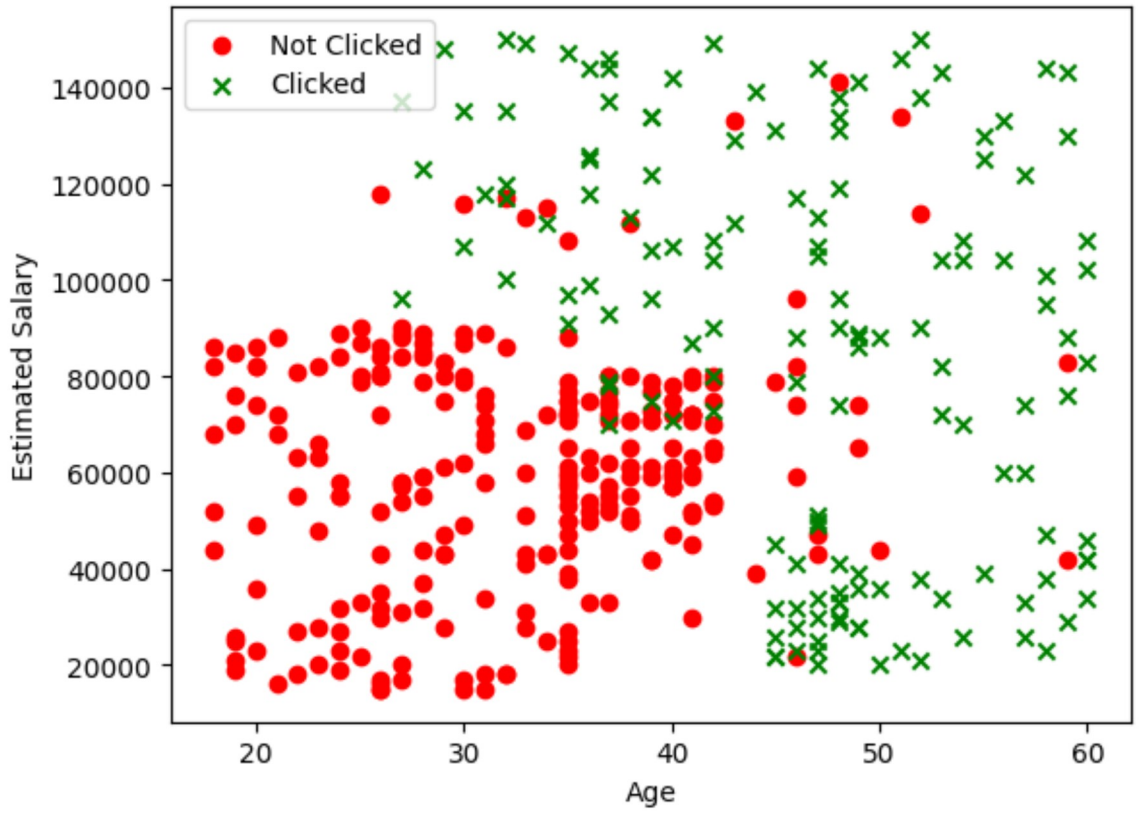
In [5]:
```
data.Purchased.unique()
```

Out[5]:
```
array([0, 1], dtype=int64)
```

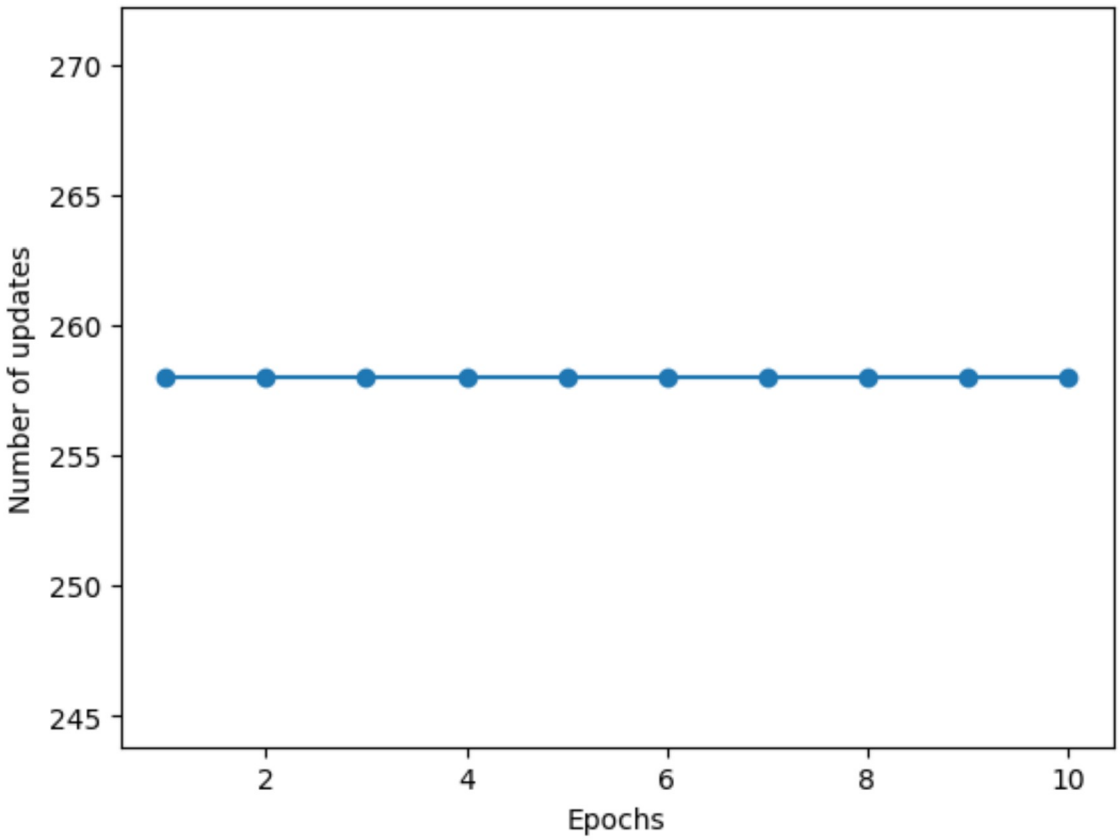
In [6]:
```
np.where(data.Purchased == 1)[0][0]
```

Out[6]:
```
257
```

In [7]:
```
y = data.iloc[:, 4].values

# extract age and salary
X = data.iloc[:, [2, 3]].values

# plot data
plt.scatter(X[:257, 0], X[:257, 1],
            color='red', marker='o', label='Not Clicked')
plt.scatter(X[257:, 0], X[257:, 1],
            color='green', marker='x', label='Clicked')

plt.xlabel('Age')
plt.ylabel('Estimated Salary')
plt.legend(loc='upper left')
plt.show()
```



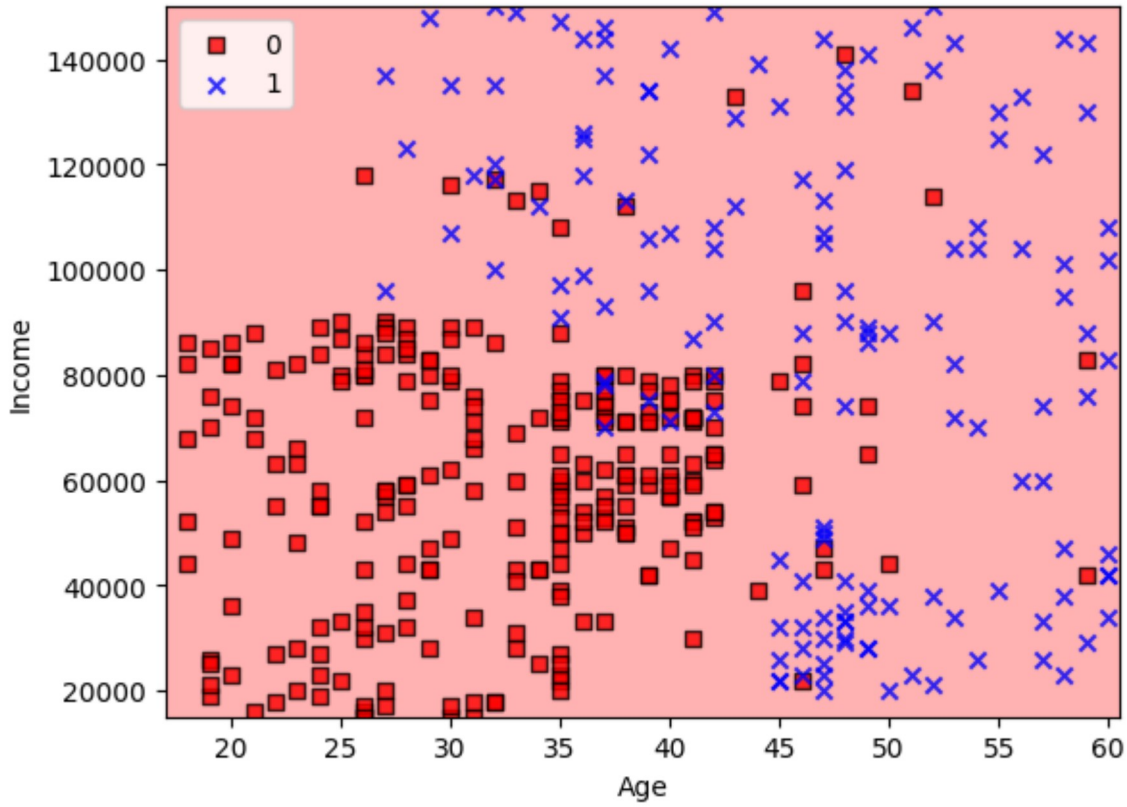
In [8]:
```
ppn = Perceptron(eta=0.1, n_iter=10)

ppn.fit(X, y)

plt.plot(range(1, len(ppn.errors_) + 1), ppn.errors_, marker='o')
plt.xlabel('Epochs')
plt.ylabel('Number of updates')
plt.show()
```



In [9]:
```
from matplotlib.colors import ListedColormap


def plot_decision_regions(X, y, classifier, resolution=0.02):

    # setup marker generator and color map
    markers = ('s', 'x', 'o', '^', 'v')
    colors = ('red', 'blue', 'lightgreen', 'gray', 'cyan')
    cmap = ListedColormap(colors[:len(np.unique(y))])

    # plot the decision surface
    x1_min, x1_max = X[:, 0].min() - 1, X[:, 0].max() + 1
    x2_min, x2_max = X[:, 1].min() - 1, X[:, 1].max() + 1
    xx1, xx2 = np.meshgrid(np.arange(x1_min, x1_max, resolution),
                           np.arange(x2_min, x2_max, resolution))
    Z = classifier.predict(np.array([xx1.ravel(), xx2.ravel()]).T)
    Z = Z.reshape(xx1.shape)
    plt.contourf(xx1, xx2, Z, alpha=0.3, cmap=cmap)
    plt.xlim(xx1.min(), xx1.max())
    plt.ylim(xx2.min(), xx2.max())

    # plot class samples
    for idx, cl in enumerate(np.unique(y)):
        plt.scatter(x=X[y == cl, 0],
                    y=X[y == cl, 1],
                    alpha=0.8,
                    c=colors[idx],
                    marker=markers[idx],
                    label=cl,
                    edgecolor='black')
```

In [10]:
```
plot_decision_regions(X, y,ppn,0.5)
plt.xlabel('Age')
plt.ylabel('Income')
plt.legend(loc='upper left')
plt.show()
```

```
C:\Users\Priya\AppData\Local\Temp\ipykernel_17732\3926436729.py:24: UserWarning:
You passed a edgecolor/edgecolors ('black') for an unfilled marker ('x').  Matpl
otlib is ignoring the edgecolor in favor of the facecolor.  This behavior may ch
ange in the future.
  plt.scatter(x=X[y == cl, 0],
```



In [11]:
```
ppn = Perceptron(0.01, 50, 1)
```

In [12]:
```
ppn.fit(X,y)
```

Out[12]:
```
<__main__.Perceptron at 0x1fae4722860>
```

In [13]:
```
ppn.predict(X)
```

Out[13]:
```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
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       1, 1, 1, 1])
```

In [14]:
```
ppn.net_input(X)
```

```
Out[14]: array([ 3418284.28737681,  2877705.50970642, 12776990.28465486,
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```