Instacart and Online Ordering

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CMSC 678

The Problem

- Find out how users shop online
- Find trends that prove hypothesis of health and online food orders
- Create a Neural Network that does Market Basket Analysis

The Dataset

- The dataset is from 2017 and was released by Instacart
- The dataset contains over 3 million orders
- The dataset is split up into six tables
  - Orders, products, departments, aisles, order_products_train & order_products_prior

	product_id	product_name	aisle_id	department_id
0	1	Chocolate Sandwich Cookies	61	19
1	2	All-Seasons Salt	104	13
2	3	Robust Golden Unsweetened Oolong Tea	94	7
3	4	Smart Ones Classic Favorites Mini Rigatoni Wit...	38	1
4	5	Green Chile Anytime Sauce	5	13

Data Cleaning

In [8]:
```
big = pd.merge(aisles, products, on='aisle_id', how='inner')
```

In [9]:
```
big.head()
```

Out[9]:

	aisle_id	aisle	product_id	product_name	department_id
0	1	prepared soups salads	209	Italian Pasta Salad	20
1	1	prepared soups salads	554	Turkey Chili	20
2	1	prepared soups salads	886	Whole Grain Salad with Roasted Pecans & Mango ...	20
3	1	prepared soups salads	1600	Mediterranean Orzo Salad	20
4	1	prepared soups salads	2539	Original Potato Salad	20

In [10]:
```
big = pd.merge(big, departments, on='department_id', how='inner')
```

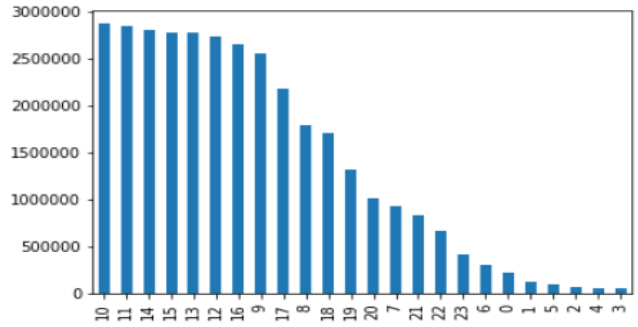
In [11]:
```
big.head()
```

Out[11]:

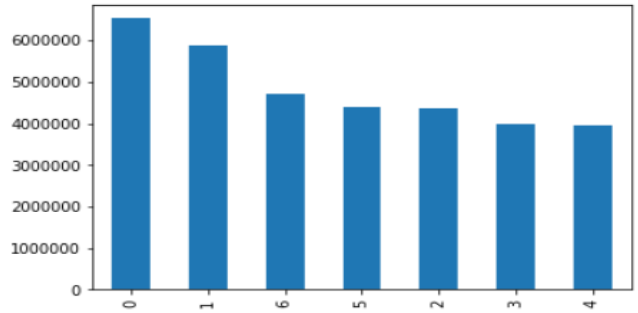
	aisle_id	aisle	product_id	product_name	department_id	department
0	1	prepared soups salads	209	Italian Pasta Salad	20	deli
1	1	prepared soups salads	554	Turkey Chili	20	deli
2	1	prepared soups salads	886	Whole Grain Salad with Roasted Pecans & Mango ...	20	deli
3	1	prepared soups salads	1600	Mediterranean Orzo Salad	20	deli
4	1	prepared soups salads	2539	Original Potato Salad	20	deli

Exploratory Analysis

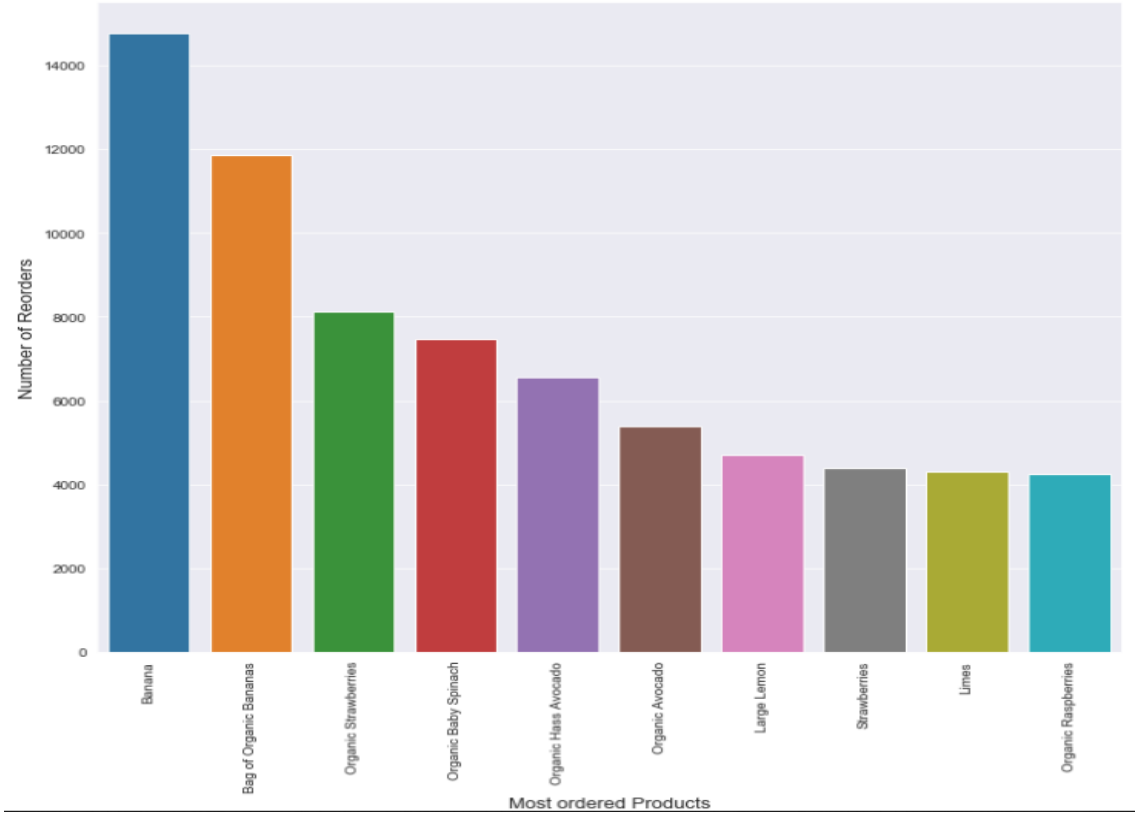
In [32]:
```
ax = big['order_hour_of_day'].value_counts().plot(kind='bar')
plt.show()
```



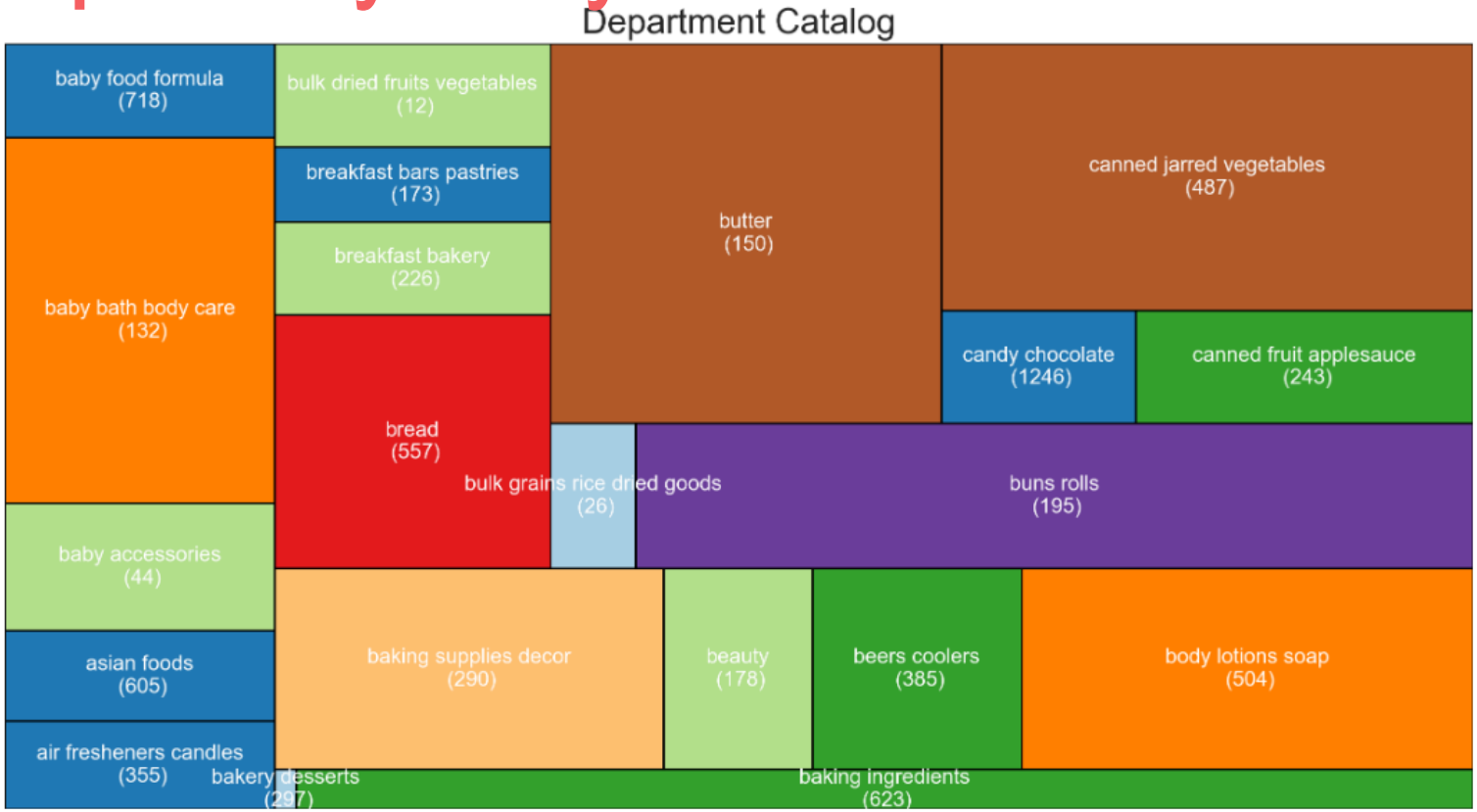
In [33]:
```
ax = big['order_dow'].value_counts().plot(kind='bar')
plt.show()
```



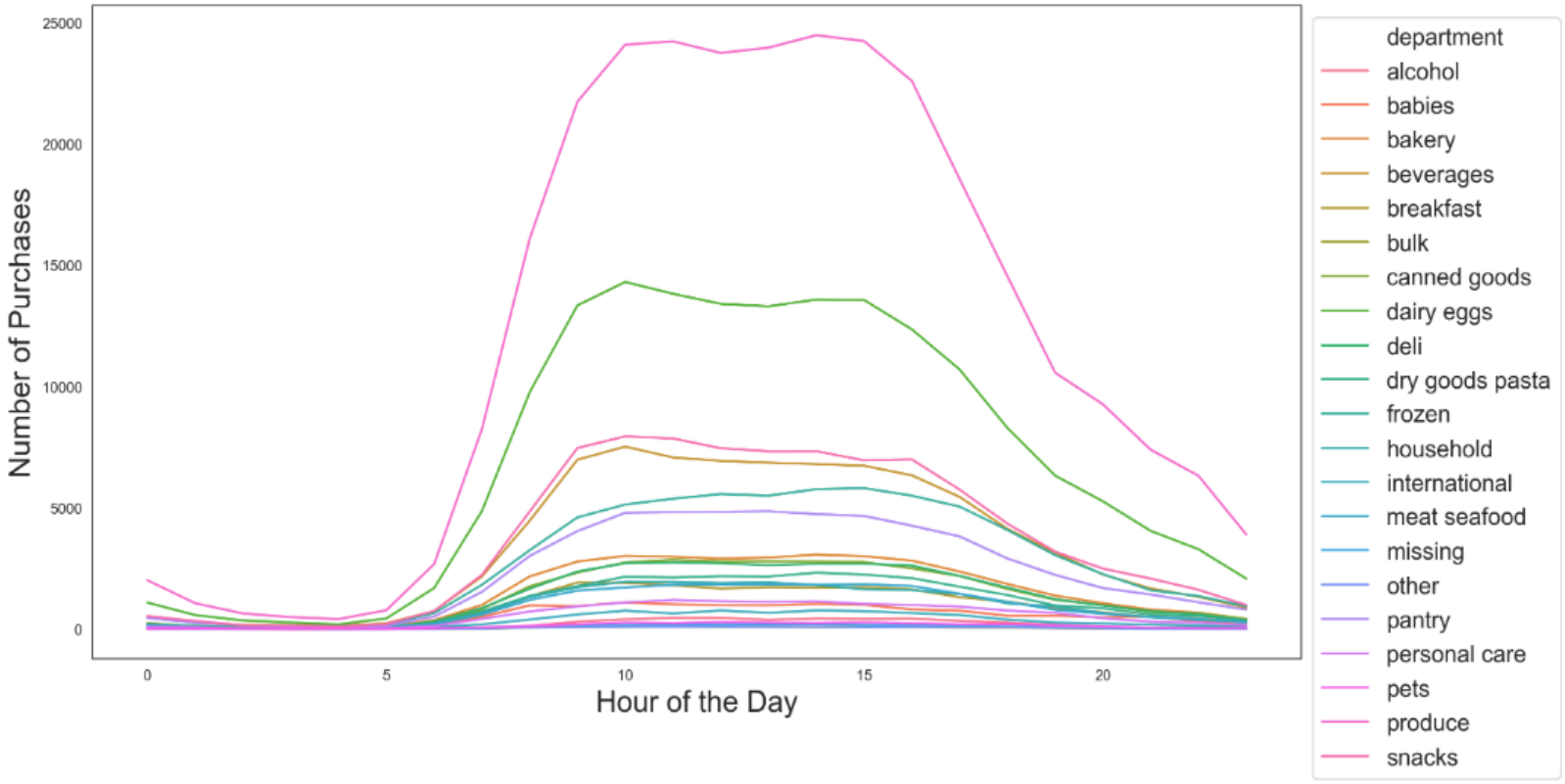
Exploratory Analysis Cont.



Exploratory Analysis Cont.



Exploratory Analysis Cont.



Neural Network Prep

```
big = pd.merge(X, cat, how='left', on='product_id')
big = big.iloc[0:1000000,]
```

```
y = big['reordered']
X = big.drop('reordered', axis=1)
encode = OneHotEncoder()
X = encode.fit_transform(X)
y = to_categorical(y)
```

```
svd = TruncatedSVD(n_components=100).fit(X)
X = svd.fit_transform(X)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33)
```

RandomSearchCV

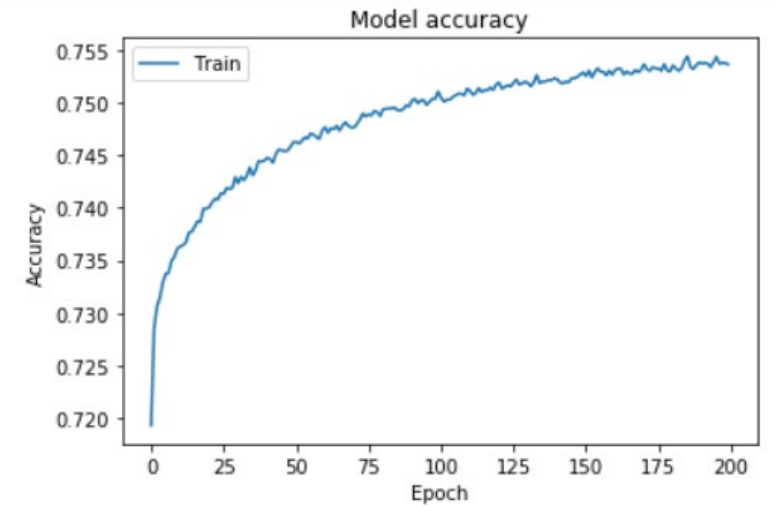
```
from keras.wrappers.scikit_learn import KerasClassifier

def create_model(optimizer='adam', neurons=64, dropout_rate=0.25):
    activation='relu'

    model = Sequential()
    model.add(BatchNormalization(axis=-1, momentum=.99, epsilon=.001, center=True, scale=True,
                                 beta_initializer='zeros', gamma_initializer='ones', moving_mean_initializer='zeros'))
    model.add(Dense(neurons, activation='relu'))
    model.add(Dropout(dropout_rate))
    model.add(Dense(neurons, activation='relu'))
    model.add(Dropout(dropout_rate))
    model.add(Dense(neurons, activation='relu'))
    model.add(Dropout(dropout_rate))
    model.add(Dense(2, activation='softmax'))

    model.compile(loss='categorical_crossentropy',
                  optimizer=optimizer,
                  metrics=['accuracy'])
    return model

model = KerasClassifier(build_fn=create_model, batch_size=128, epochs=50)
```

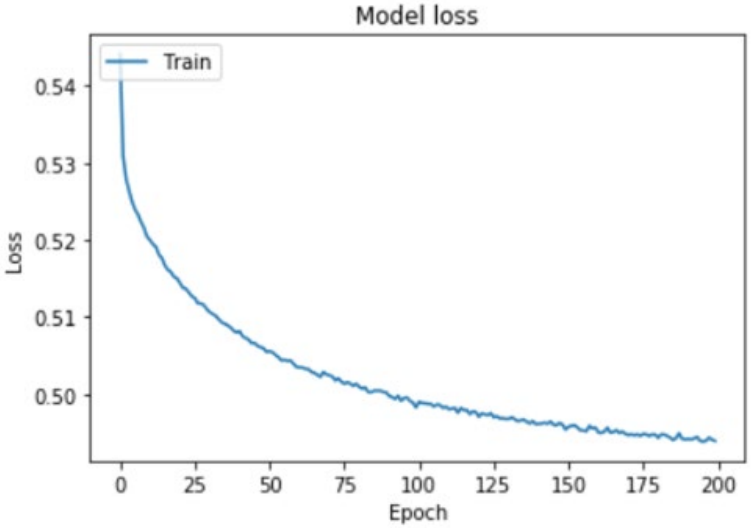
RandomSearchCV Results

```
from sklearn.model_selection import RandomizedSearchCV

params = {'neurons':[256,512],
          'dropout_rate':[0.25,0.5,0.75],
          'optimizer':['adam','sgd']}

grid = RandomizedSearchCV(estimator=model, param_distributions=params,
                          verbose=2, n_jobs=-1)
grid.fit(X_train, y_train)
grid.best_params_
```

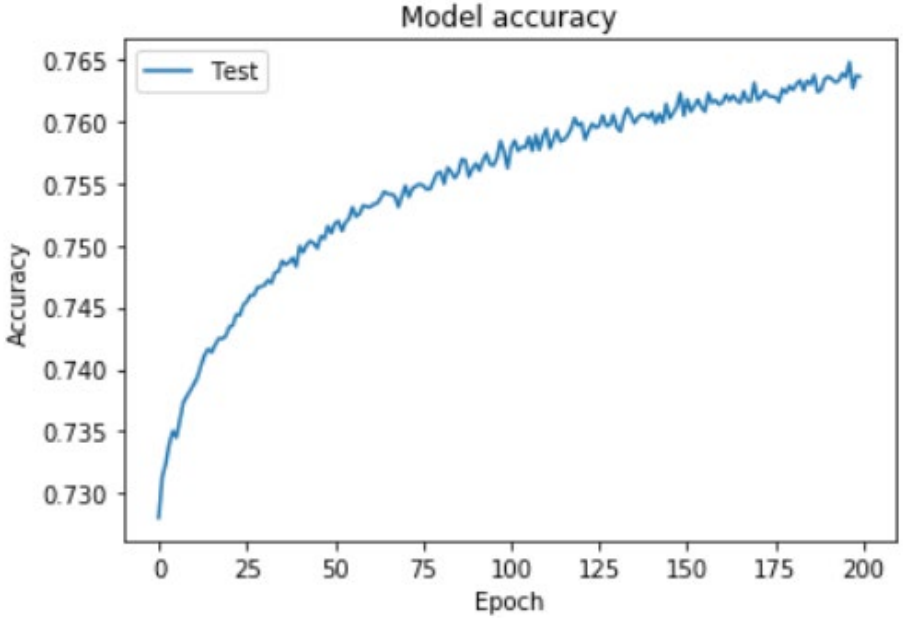
```
Epoch 42/50
670000/670000 [==============================] - 46s 69us/step - loss: 0.5300 - accuracy: 0.7293
Epoch 43/50
670000/670000 [==============================] - 46s 68us/step - loss: 0.5306 - accuracy: 0.7289
Epoch 44/50
670000/670000 [==============================] - 46s 69us/step - loss: 0.5304 - accuracy: 0.7292
Epoch 45/50
670000/670000 [==============================] - 46s 69us/step - loss: 0.5302 - accuracy: 0.7297
Epoch 46/50
670000/670000 [==============================] - 48s 72us/step - loss: 0.5300 - accuracy: 0.7298
Epoch 47/50
670000/670000 [==============================] - 46s 68us/step - loss: 0.5302 - accuracy: 0.7293
Epoch 48/50
670000/670000 [==============================] - 46s 68us/step - loss: 0.5304 - accuracy: 0.7294
Epoch 49/50
670000/670000 [==============================] - 45s 68us/step - loss: 0.5305 - accuracy: 0.7294
Epoch 50/50
670000/670000 [==============================] - 49s 74us/step - loss: 0.5302 - accuracy: 0.7296

{'optimizer': 'adam', 'neurons': 256, 'dropout_rate': 0.5}
```

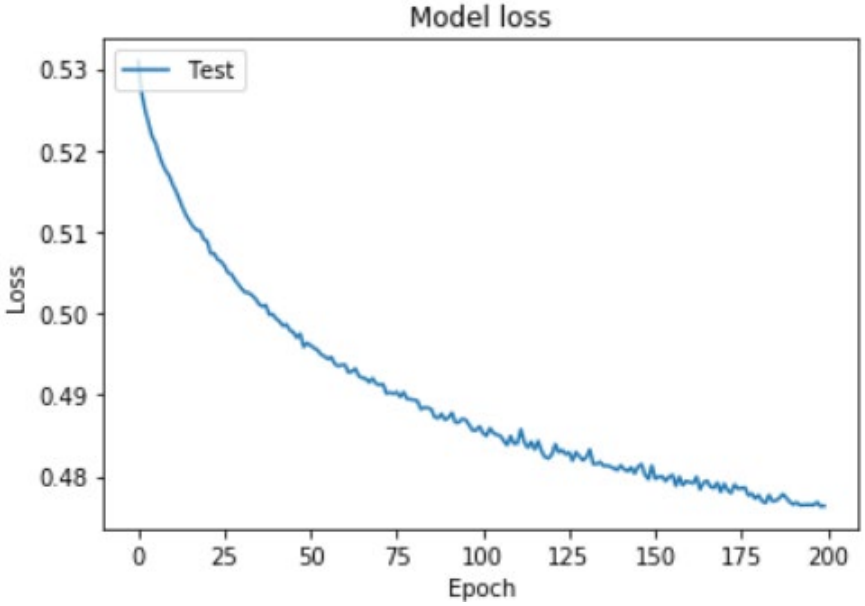
Training Data Results





Testing Data Results





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