In [1]:

```
import pandas as pd
import numpy as np
%matplotlib inline
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import r2_score
from keras.models import Sequential
from keras.layers import Dense
from keras.callbacks import EarlyStopping
from keras.optimizers import Adam
from keras.layers import LSTM
from keras.layers import GRU
import tensorflow as tf
import math
from keras.layers import Dense, LSTM, Dropout, GRU, Bidirectional
from sklearn.metrics import mean_squared_error
```

```
Using TensorFlow backend.
```

In [36]:

```
dataset = pd.read_csv('googl.csv', index_col='Date', parse_dates=['Date'])
dataset.tail()
```

Out[36]:

	Close	High	Low	Open	Adj Close	Volume
Date						
2019-04-26	1272.180054	1273.069946	1260.319946	1269.000000	1272.180054	1241400
2019-04-29	1287.579956	1289.270020	1266.295044	1274.000000	1287.579956	2499400
2019-04-30	1188.479980	1192.810059	1175.000000	1185.000000	1188.479980	6207000
2019-05-01	1168.079956	1188.050049	1167.180054	1188.050049	1168.079956	2639200
2019-05-02	1162.609985	1174.189941	1155.001953	1167.760010	1162.609985	1943700

In [ ]:

In [37]:

```
def get_technical_indicators(dataset):
    # Create 7 and 21 days Moving Average
    dataset['ma7'] = dataset['Close'].rolling(window=7).mean()
    dataset['ma21'] = dataset['Close'].rolling(window=21).mean()

    # Create MACD
    dataset['26ema'] = dataset['Close'].ewm(span=26).mean()
    dataset['12ema'] = dataset['Close'].ewm(span=12).mean()
    dataset['MACD'] = (dataset['12ema']-dataset['26ema'])

    # Create Bollinger Bands
    dataset['20sd'] = pd.stats.moments.rolling_std(dataset['Close'],20)
    dataset['upper_band'] = dataset['ma21'] + (dataset['20sd']*2)
    dataset['lower_band'] = dataset['ma21'] - (dataset['20sd']*2)



    # Create Exponential moving average
    dataset['ema'] = dataset['Close'].ewm(com=0.5).mean()

    # Create Momentum
    dataset['momentum'] = dataset['Close']-1

    return dataset
```

In [38]:

```
dataset_TI = get_technical_indicators(dataset[['Close']])
```

```
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:3: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stab
le/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy)
  This is separate from the ipykernel package so we can avoid doing imports unt
il
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:4: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stab
le/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy)
  after removing the cwd from sys.path.
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:7: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stab
le/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy)
  import sys
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:8: Setti
ngWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stab
le/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pandas-doc
s/stable/indexing.html#indexing-view-versus-copy)

/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:12: Futu
reWarning: pd.rolling_std is deprecated for Series and will be removed in a fut
ure version, replace with
        Series.rolling(window=20,center=False).std()
  if sys.path[0] == '':
```

In [39]:

```
def RSI(series, period):
 delta = series.diff().dropna() #daily positive differences, i.e. gains.
 u = delta * 0
 d = u.copy()                   #daily negative difference, i.e. losses

 u[delta > 0] = delta[delta > 0] #Average daily positive differences for the peri
 d[delta < 0] = -delta[delta < 0] #Average daily negative difference for the peri
 u[u.index[period-1]] = np.mean( u[:period] ) #first value is sum of avg gains
 u = u.drop(u.index[:(period-1)])
 d[d.index[period-1]] = np.mean( d[:period] ) #first value is sum of avg losses
 d = d.drop(d.index[:(period-1)])
 rs = pd.stats.moments.ewma(u, com=period-1, adjust=False) / \
 pd.stats.moments.ewma(d, com=period-1, adjust=False)
 return 100 - 100 / (1 + rs)
```

In [40]:

```
dataset_TI['RSI'] = RSI(dataset['Close'], 14)
dataset_TI.head()
```

```
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:12: Futu
reWarning: pd.ewm_mean is deprecated for Series and will be removed in a future
version, replace with
        Series.ewm(com=13,min_periods=0,adjust=False,ignore_na=False).mean()
  if sys.path[0] == '':
/Users/san/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:13: Futu
reWarning: pd.ewm_mean is deprecated for Series and will be removed in a future
version, replace with
        Series.ewm(com=13,min_periods=0,adjust=False,ignore_na=False).mean()
  del sys.path[0]
```

Out[40]:

	Close	ma7	ma21	26ema	12ema	MACD	20sd	upper_band	lower_band	ema
Date										
2013-05-02	412.124542	NaN	NaN	412.124542	412.124542	0.000000	NaN	NaN	NaN	412.1245
2013-05-03	420.127472	NaN	NaN	416.279910	416.459462	0.179553	NaN	NaN	NaN	418.1267
2013-05-06	427.991333	NaN	NaN	420.487710	420.960354	0.472644	NaN	NaN	NaN	424.9560
2013-05-07	425.845276	NaN	NaN	421.985452	422.502333	0.516882	NaN	NaN	NaN	425.5562
2013-05-08	433.992310	NaN	NaN	424.769892	425.624119	0.854227	NaN	NaN	NaN	431.2035

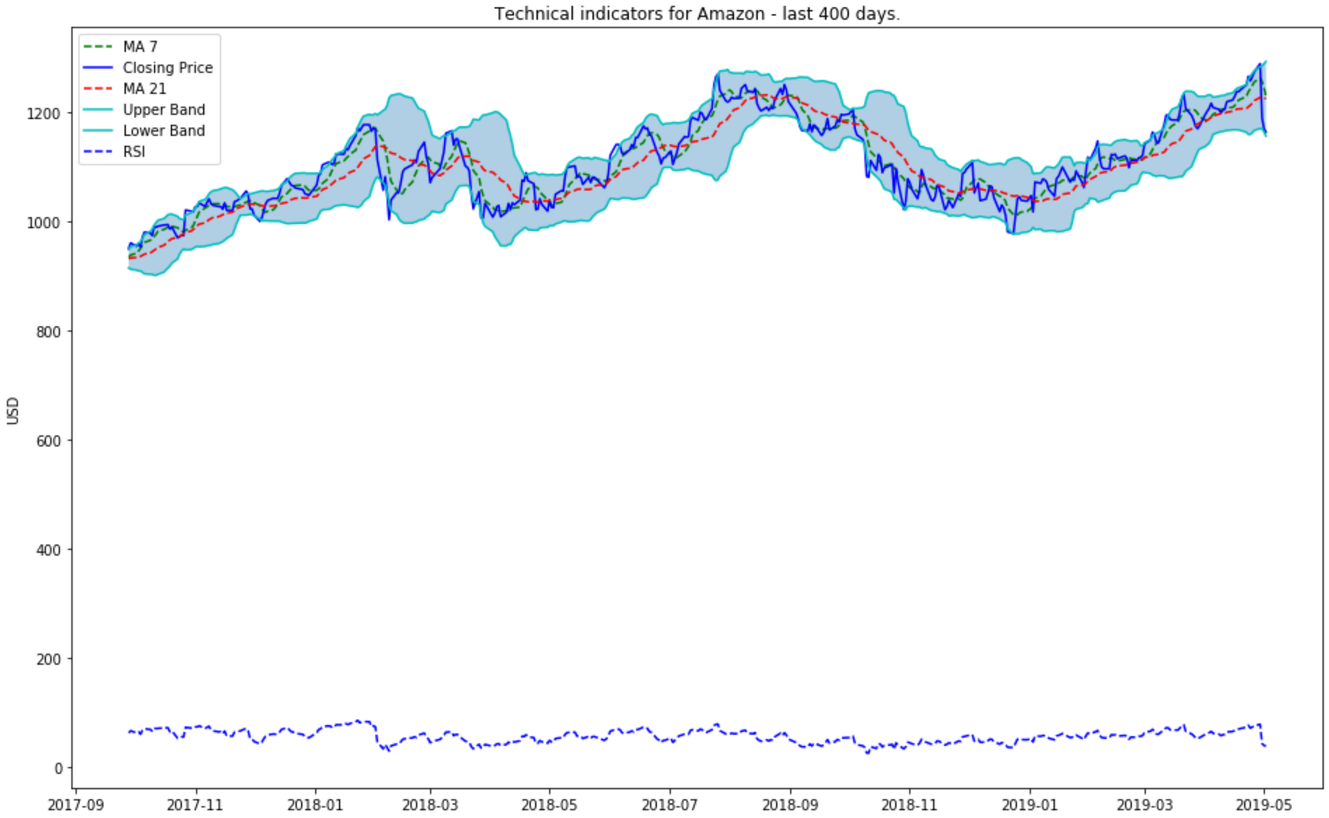
In [41]:

```
dataset_TI = dataset_TI[~np.isnan(dataset).any(axis=1)]
```

In [42]:

```
def plot_technical_indicators(dataset, last_days):
    plt.figure(figsize=(16, 10))
    shape_0 = dataset_TI.shape[0]
    xmacd_ = shape_0-last_days

    dataset = dataset_TI.iloc[-last_days:, :]
    x_ = range(3, dataset.shape[0])
    x_ =list(dataset.index)


    plt.plot(dataset['ma7'],label='MA 7', color='g',linestyle='--')
    plt.plot(dataset['Close'],label='Closing Price', color='b')
    plt.plot(dataset['ma21'],label='MA 21', color='r',linestyle='--')
    plt.plot(dataset['upper_band'],label='Upper Band', color='c')
    plt.plot(dataset['lower_band'],label='Lower Band', color='c')
    plt.plot(dataset['RSI'],label='RSI', color='b',linestyle='--')

    plt.fill_between(x_, dataset['lower_band'], dataset['upper_band'], alpha=.35)
    plt.title('Technical indicators for Amazon - last {} days.'.format(last_days))
    plt.ylabel('USD')
    plt.legend()

    plt.legend()
    plt.show()
```

In [43]:
```
plot_technical_indicators(dataset, 400)
```



In [44]:
```
def get_feature_importance_data(data_income):
    data = data_income.copy()
    y = data['Close']
    X = data.iloc[:, 1:]

    train_samples = int(X.shape[0] * 0.65)

    X_train = X.iloc[:train_samples]
    X_test = X.iloc[train_samples:]

    y_train = y.iloc[:train_samples]
    y_test = y.iloc[train_samples:]

    return (X_train, y_train), (X_test, y_test)
```

In [45]:
```
(X_train, y_train), (X_test, y_test) = get_feature_importance_data(dataset_TI)
```

In [46]:
```
import xgboost as xgb

regressor = xgb.XGBRegressor(gamma=0.0,n_estimators=150,base_score=0.7,colsample_
```

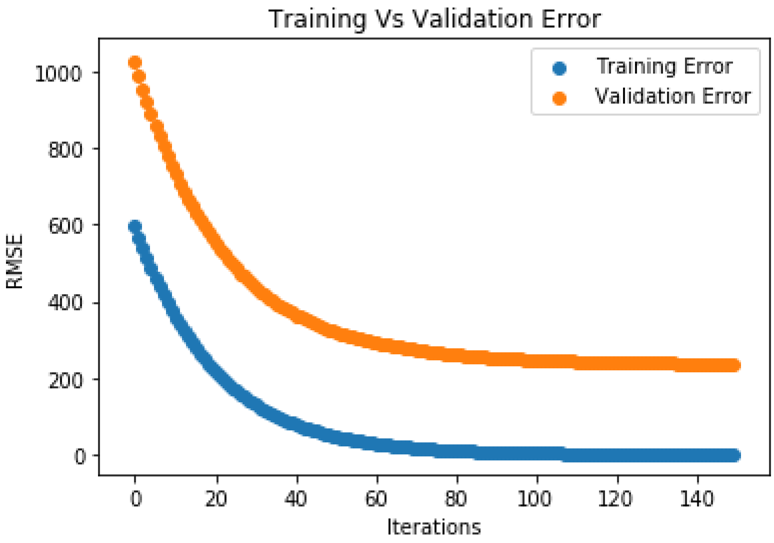
In [47]:
```
xgbModel = regressor.fit(X_train,y_train,eval_set = [(X_train, y_train), (X_test,
                         verbose=False)
```

In [48]:
```
eval_result = regressor.evals_result()
```

In [49]:
```
training_rounds = range(len(eval_result['validation_0']['rmse']))
```

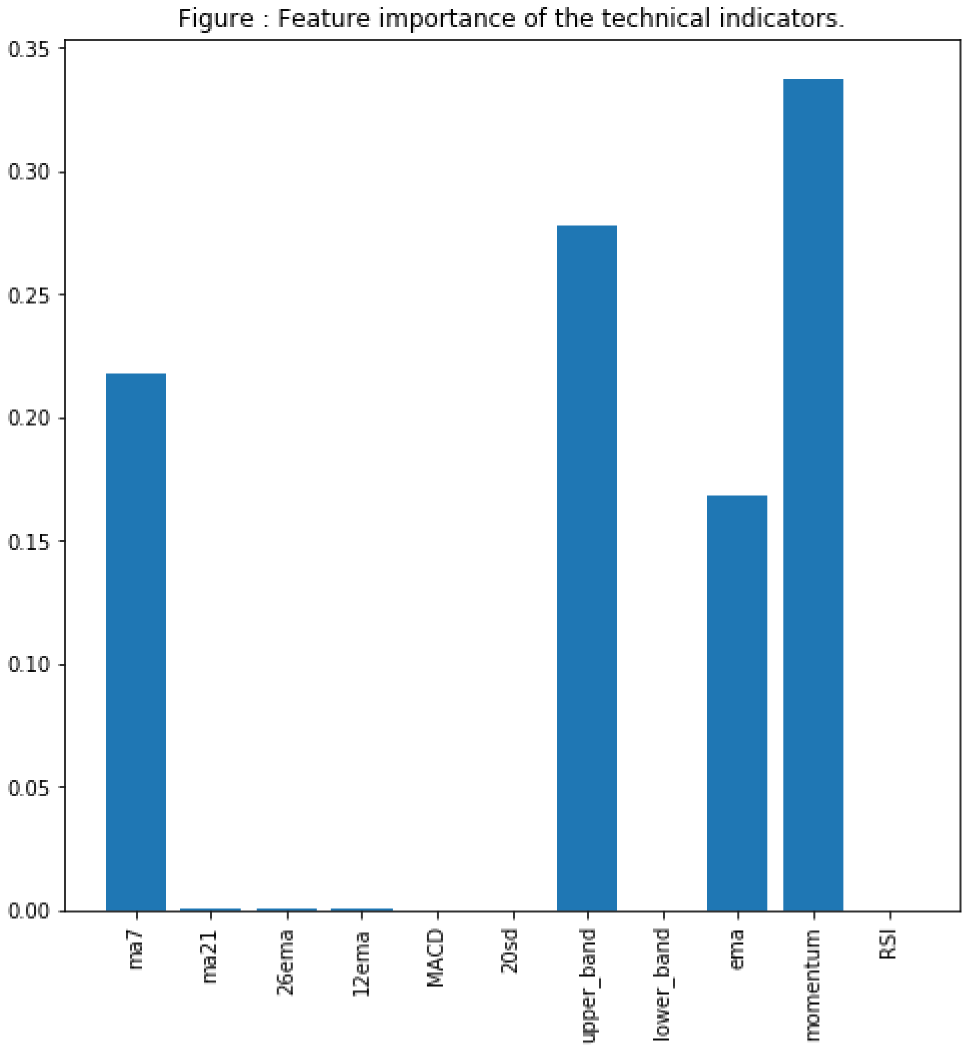
In [50]:

```
plt.scatter(x=training_rounds,y=eval_result['validation_0']['rmse'],label='Traini
plt.scatter(x=training_rounds,y=eval_result['validation_1']['rmse'],label='Valida
plt.xlabel('Iterations')
plt.ylabel('RMSE')
plt.title('Training Vs Validation Error')
plt.legend()
plt.show()
```



In [51]:

```
 = plt.figure(figsize=(8,8))
.xticks(rotation='vertical')
.bar([i for i in range(len(xgbModel.feature_importances_))], xgbModel.feature_impo
.title('Figure : Feature importance of the technical indicators.')
.show()
```



In [ ]: