

# ZLEMA

September 29, 2021

## 1 Zero Lag Exponential Moving Average (ZLEMA)

<https://www.fmlabs.com/reference/default.htm?url=DMI.htm>

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

import warnings
warnings.filterwarnings("ignore")

# fix_yahoo_finance is used to fetch data
import fix_yahoo_finance as yf
yf.pdr_override()
```

```
[2]: # input
symbol = 'AAPL'
start = '2018-08-01'
end = '2018-12-31'

# Read data
df = yf.download(symbol,start,end)

# View Columns
df.head()
```

[\*\*\*\*\*100%\*\*\*\*\*] 1 of 1 downloaded

```
[2]:
```

	Open	High	Low	Close	Adj Close	\
Date						
2018-08-01	199.130005	201.759995	197.309998	201.500000	198.478760	
2018-08-02	200.580002	208.380005	200.350006	207.389999	204.280457	
2018-08-03	207.029999	208.740005	205.479996	207.990005	204.871445	
2018-08-06	208.000000	209.250000	207.070007	209.070007	205.935257	
2018-08-07	209.320007	209.500000	206.759995	207.110001	204.004639	

	Volume
Date	

```

2018-08-01  67935700
2018-08-02  62404000
2018-08-03  33447400
2018-08-06  25425400
2018-08-07  25587400

```

```

[3]: n = 14
      lag = (n - 1) / 2
      df['ZLEMA'] = pd.Series(df['Adj Close'] + df['Adj Close'].diff(lag))

```

```

[4]: df.head(20)

```

```

[4]:
      Date      Open      High      Low      Close  Adj Close  \
2018-08-01  199.130005  201.759995  197.309998  201.500000  198.478760
2018-08-02  200.580002  208.380005  200.350006  207.389999  204.280457
2018-08-03  207.029999  208.740005  205.479996  207.990005  204.871445
2018-08-06  208.000000  209.250000  207.070007  209.070007  205.935257
2018-08-07  209.320007  209.500000  206.759995  207.110001  204.004639
2018-08-08  206.050003  207.809998  204.520004  207.250000  204.142532
2018-08-09  207.279999  209.779999  207.199997  208.880005  205.748108
2018-08-10  207.360001  209.100006  206.669998  207.529999  205.135254
2018-08-13  207.699997  210.949997  207.699997  208.869995  206.459793
2018-08-14  210.160004  210.559998  208.259995  209.750000  207.329651
2018-08-15  209.220001  210.740005  208.330002  210.240005  207.813995
2018-08-16  211.750000  213.809998  211.470001  213.320007  210.858459
2018-08-17  213.440002  217.949997  213.160004  217.580002  215.069290
2018-08-20  218.100006  219.179993  215.110001  215.460007  212.973755
2018-08-21  216.800003  217.190002  214.029999  215.039993  212.558609
2018-08-22  214.100006  216.360001  213.839996  215.050003  212.568481
2018-08-23  214.649994  217.050003  214.600006  215.490005  213.003418
2018-08-24  216.600006  216.899994  215.110001  216.160004  213.665680
2018-08-27  217.149994  218.740005  216.330002  217.940002  215.425140
2018-08-28  219.009995  220.539993  218.919998  219.699997  217.164825

```

```

      Volume      ZLEMA
Date
2018-08-01  67935700      NaN
2018-08-02  62404000      NaN
2018-08-03  33447400      NaN
2018-08-06  25425400      NaN
2018-08-07  25587400      NaN
2018-08-08  22525500      NaN
2018-08-09  23469200  213.017456
2018-08-10  24611200  205.990051
2018-08-13  25869100  208.048141
2018-08-14  20748000  208.724045

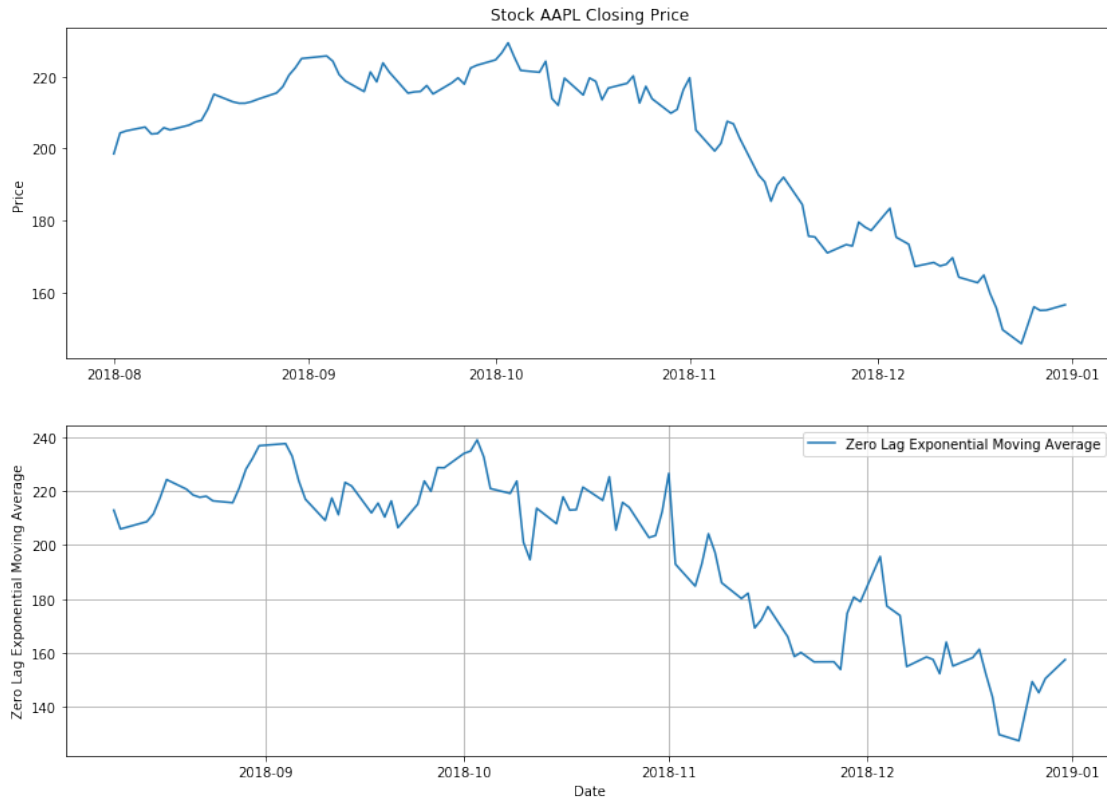
```

2018-08-15	28807600	211.623351
2018-08-16	28500400	217.574386
2018-08-17	35427000	224.390472
2018-08-20	30287700	220.812256
2018-08-21	26159800	218.657425
2018-08-22	19018100	217.807311
2018-08-23	18883200	218.192841
2018-08-24	18476400	216.472901
2018-08-27	20525100	215.780990
2018-08-28	22776800	221.355895

```
[5]: fig = plt.figure(figsize=(14,10))
ax1 = plt.subplot(2, 1, 1)
ax1.plot(df['Adj Close'])
ax1.set_title('Stock ' + symbol + ' Closing Price')
ax1.set_ylabel('Price')

ax2 = plt.subplot(2, 1, 2)
ax2.plot(df['ZLEMA'], label='Zero Lag Exponential Moving Average')
ax2.grid()
ax2.legend(loc='best')
ax2.set_ylabel('Zero Lag Exponential Moving Average')
ax2.set_xlabel('Date')
```

```
[5]: Text(0.5,0,'Date')
```



## 1.1 Candlestick with Zero Lag Exponential Moving Average

```
[6]: from matplotlib import dates as mdates
import datetime as dt

dfc = df.copy()
dfc['VolumePositive'] = dfc['Open'] < dfc['Adj Close']
#dfc = dfc.dropna()
dfc = dfc.reset_index()
dfc['Date'] = mdates.date2num(dfc['Date'].astype(dt.date))
dfc.head()
```

```
[6]:
```

	Date	Open	High	Low	Close	Adj Close	\
0	736907.0	199.130005	201.759995	197.309998	201.500000	198.478760	
1	736908.0	200.580002	208.380005	200.350006	207.389999	204.280457	
2	736909.0	207.029999	208.740005	205.479996	207.990005	204.871445	
3	736912.0	208.000000	209.250000	207.070007	209.070007	205.935257	
4	736913.0	209.320007	209.500000	206.759995	207.110001	204.004639	

	Volume	ZLEMA	VolumePositive
0	67935700	NaN	False

1	62404000	NaN	True
2	33447400	NaN	False
3	25425400	NaN	False
4	25587400	NaN	False

```
[7]: from mpl_finance import candlestick_ohlc

fig = plt.figure(figsize=(14,10))
ax1 = plt.subplot(2, 1, 1)
candlestick_ohlc(ax1,dfc.values, width=0.5, colorup='g', colordown='r', alpha=1.
    ↪0)
ax1.xaxis_date()
ax1.xaxis.set_major_formatter(mdates.DateFormatter('%d-%m-%Y'))
ax1.grid(True, which='both')
ax1.minorticks_on()
ax1v = ax1.twinx()
colors = dfc.VolumePositive.map({True: 'g', False: 'r'})
ax1v.bar(dfc.Date, dfc['Volume'], color=colors, alpha=0.4)
ax1v.axes.yaxis.set_ticklabels([])
ax1v.set_ylim(0, 3*df.Volume.max())
ax1.set_title('Stock ' + symbol + ' Closing Price')
ax1.set_ylabel('Price')

ax2 = plt.subplot(2, 1, 2)
ax2.plot(df['ZLEMA'], label='Zero Lag Exponential Moving Average')
ax2.grid()
ax2.legend(loc='best')
ax2.set_ylabel('Zero Lag Exponential Moving Average')
ax2.set_xlabel('Date')
```

```
[7]: Text(0.5,0,'Date')
```

