from \_\_future\_\_ import print\_function

import datetime

import numpy as np

from matplotlib import cm, pyplot as plt

from matplotlib.dates import YearLocator, MonthLocator

try:

from matplotlib.finance import quotes\_historical\_yahoo\_ochl

except ImportError:

# For Matplotlib prior to 1.5.

from matplotlib.finance import (

quotes\_historical\_yahoo as quotes\_historical\_yahoo\_ochl

)

from hmmlearn.hmm import GaussianHMM

print(\_\_doc\_\_)

*"Import data from excel"*

from xlrd import open\_workbook

import math as m

book = open\_workbook(*'data.xlsx'*)

sheet = book.sheet\_by\_index(0)

time\_x = []

current\_y = []

for k in range(1,sheet.nrows):

time\_x.append(str(sheet.row\_values(k)[1-1]))

current\_y.append(str(sheet.row\_values(k)[2-1]))

time\_xx = map(float, time\_x)

current\_yy = map(float, current\_y)

x = np.asarray(time\_xx)

y = np.asarray(current\_yy)

X = np.reshape(y,(-1,1))

*"Run Gaussian HMM"*

print(*"fitting to HMM and decoding ..."*, end=*""*)

# Make an HMM instance and execute fit

model = GaussianHMM(n\_components=30, covariance\_type=*"full"*, n\_iter=3000).fit(X)

# Predict the optimal sequence of internal hidden state

hidden\_states = model.predict(X)

print(*"hidden\_states"*, len(hidden\_states), hidden\_states)

print(*"done"*)

*"Print All hidden state parameter"*

print(*"Transition matrix"*)

print(model.transmat\_)

print()

print(*"Means and vars of each hidden state"*)

for i in range(model.n\_components):

print(*"{0}th hidden state"*.format(i))

print(*"mean = "*, model.means\_[i])

print(*"var = "*, np.diag(model.covars\_[i]))

print()

*"Hidden state"*

result = []

test = hidden\_states[0]

for ind, i in enumerate(hidden\_states):

if i != test:

if len(result) == 0:

result.append([test,0,ind-1])

else:

start = result[-1][2]+1

result.append([test,start,ind-1])

test = i

print(result)

# for i in range(0,len(hidden\_states)):

# print(i, ",", hidden\_states[i])

*"Plot data and result"*

x\_plot = []

y\_plot = []

for i in result:

x\_plot.append(i[1])

x\_plot.append(i[2])

y\_plot.append(model.means\_[i[0]])

y\_plot.append(model.means\_[i[0]])

plt.figure(1)

plt.title(*"hmm vs data"*)

plt.plot(x,y, *'r'*)#, x,y, 'bo')

plt.plot(x\_plot, y\_plot, *'k'*)

plt.show()

result component : 30

hidden\_states 9937 [21 21 21 ..., 6 6 6]

done

Transition matrix

[[ 3.75480331e-003 0.00000000e+000 6.86947974e-044 0.00000000e+000

3.85973943e-018 2.22300587e-071 5.53936616e-001 1.92496769e-156

6.90137825e-003 1.80983148e-127 1.01613707e-121 2.02114805e-018

1.37302549e-035 0.00000000e+000 8.92768816e-115 2.07539295e-107

2.95849888e-102 3.13796274e-001 1.37456002e-057 0.00000000e+000

5.26313869e-061 2.63438887e-235 1.21610928e-001 0.00000000e+000

7.26746413e-025 1.97506262e-043 7.19157610e-162 1.36746493e-064

8.21444903e-110 0.00000000e+000]

[ 0.00000000e+000 9.44582459e-001 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 5.58947260e-003 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 3.70581115e-002

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 1.27699567e-002

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000]

[ 6.02754103e-003 0.00000000e+000 8.57894951e-001 0.00000000e+000

4.60279675e-166 2.36937471e-256 2.21428354e-002 0.00000000e+000

6.97136077e-013 5.77194136e-258 8.73554464e-275 1.27700317e-198

1.03010178e-002 0.00000000e+000 0.00000000e+000 0.00000000e+000

1.03633655e-001 5.19337686e-106 1.68372230e-093 0.00000000e+000

0.00000000e+000 0.00000000e+000 1.18210499e-113 0.00000000e+000

3.20236328e-045 6.01407423e-120 3.88127691e-071 5.21170950e-116

0.00000000e+000 0.00000000e+000]

[ 0.00000000e+000 0.00000000e+000 0.00000000e+000 8.58516174e-001

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 1.41483826e-001]

[ 4.69047012e-041 0.00000000e+000 0.00000000e+000 0.00000000e+000

9.20181450e-001 6.21129568e-003 6.79148471e-034 0.00000000e+000

3.64795461e-050 2.85229202e-107 1.57256554e-002 4.48460486e-003

1.33264080e-032 0.00000000e+000 1.08338456e-077 0.00000000e+000

2.50265213e-309 6.05258443e-003 4.75720036e-172 1.28529291e-274

1.35116181e-021 1.72705038e-067 2.16094053e-010 0.00000000e+000

4.73444097e-002 7.73102511e-026 2.59992071e-103 1.42103424e-057

5.80163204e-063 0.00000000e+000]

[ 3.86505965e-115 0.00000000e+000 0.00000000e+000 0.00000000e+000

5.80112118e-035 4.40394834e-001 1.31851306e-058 0.00000000e+000

3.88551628e-124 4.60316328e-001 3.09519829e-071 1.65092149e-032

4.53660431e-092 0.00000000e+000 3.06675492e-113 0.00000000e+000

0.00000000e+000 8.18577740e-103 1.93922884e-268 3.86940636e-040

2.02561154e-027 8.56105048e-002 1.91745000e-075 0.00000000e+000

5.49303086e-150 1.67520765e-226 1.36783332e-002 2.99310749e-210

1.87946028e-015 0.00000000e+000]

[ 1.13219604e-002 0.00000000e+000 5.73861899e-272 0.00000000e+000

9.38411573e-018 8.60049021e-147 8.47011984e-001 6.82453719e-004

1.38072042e-007 4.30446735e-267 6.38421761e-118 2.89318605e-003

3.88888427e-048 0.00000000e+000 3.97065681e-136 6.75258992e-004

1.10801332e-003 8.17402094e-002 5.31281620e-003 0.00000000e+000

8.96618311e-034 8.94945845e-271 8.73960413e-007 0.00000000e+000

4.92531054e-002 1.08370518e-027 8.35973032e-124 1.59918023e-052

1.55481772e-139 0.00000000e+000]

[ 2.03060301e-125 0.00000000e+000 1.74619070e-183 0.00000000e+000

3.68184004e-269 1.45127906e-314 2.86255532e-111 3.07175114e-057

9.60628908e-148 0.00000000e+000 1.62707620e-001 1.33934498e-037

2.72351081e-190 6.73940927e-001 0.00000000e+000 0.00000000e+000

5.00669587e-176 1.63351453e-001 8.25399735e-142 0.00000000e+000

6.96814192e-252 5.00005248e-299 9.41513491e-064 0.00000000e+000

0.00000000e+000 0.00000000e+000 6.35186813e-227 9.09080788e-322

0.00000000e+000 0.00000000e+000]

[ 1.10330321e-001 0.00000000e+000 3.56765162e-293 0.00000000e+000

1.40608200e-145 8.54701659e-188 6.91720323e-001 0.00000000e+000

9.90768088e-007 2.88060928e-273 5.86618393e-208 3.42613961e-017

4.71895014e-175 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 1.63626116e-001 3.43222491e-002 0.00000000e+000

8.88356835e-061 0.00000000e+000 2.15386294e-052 0.00000000e+000

6.04214852e-037 1.64118084e-158 0.00000000e+000 1.31309551e-138

1.70770758e-270 0.00000000e+000]

[ 5.23953786e-063 0.00000000e+000 5.86204518e-308 8.14866280e-233

2.08282017e-045 1.72610314e-001 7.85709774e-042 0.00000000e+000

2.17932151e-074 7.39844525e-001 8.55755127e-046 2.78257308e-089

6.73901644e-080 0.00000000e+000 1.48306911e-226 0.00000000e+000

4.24447162e-204 2.09353800e-155 4.17841563e-232 2.93221338e-018

1.80889869e-003 3.83593683e-002 2.88621578e-097 0.00000000e+000

2.07997605e-146 1.96709060e-185 1.00629989e-002 1.55439609e-176

3.73138947e-002 0.00000000e+000]

[ 4.53959291e-126 0.00000000e+000 0.00000000e+000 0.00000000e+000

4.79756979e-027 7.16405916e-088 5.27072382e-112 2.89404518e-162

7.29534872e-111 2.41524236e-062 1.90429424e-106 2.49122313e-001

1.87057575e-052 0.00000000e+000 1.68083478e-001 3.85063176e-259

0.00000000e+000 3.83807823e-016 0.00000000e+000 5.44861817e-173

3.89425405e-001 9.66012421e-057 8.01332162e-043 0.00000000e+000

3.10214124e-098 1.89383966e-164 1.93368805e-001 6.30387027e-133

1.74527513e-121 0.00000000e+000]

[ 1.18387106e-006 0.00000000e+000 1.97836131e-003 0.00000000e+000

5.68102175e-031 1.45439104e-022 1.00041511e-003 1.91679542e-119

3.13735844e-012 1.88552245e-050 5.82662586e-041 8.18382396e-001

3.73645735e-019 0.00000000e+000 1.27086909e-003 5.95522728e-043

4.38210766e-046 7.08900601e-003 5.87560220e-025 0.00000000e+000

1.19417752e-001 4.03359327e-141 5.08600163e-002 0.00000000e+000

1.75950643e-012 3.28699906e-095 8.05516571e-157 4.52555082e-062

4.96960570e-117 0.00000000e+000]

[ 2.57915950e-075 0.00000000e+000 6.64088477e-179 0.00000000e+000

9.16732296e-125 6.95925068e-002 1.76193679e-052 1.19362811e-195

1.26173479e-057 2.25502106e-022 1.66912339e-099 6.07271784e-032

7.84014543e-001 0.00000000e+000 4.97436772e-109 2.30546750e-190

2.61193645e-300 1.68024212e-050 1.46382600e-001 9.78211986e-294

1.03503629e-005 1.96444911e-103 8.13042298e-033 0.00000000e+000

5.80447632e-085 2.62864790e-097 1.51603545e-090 3.71465272e-119

4.56659721e-104 0.00000000e+000]

[ 0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 2.84592580e-002

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 9.71540742e-001 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000]

[ 4.08404324e-147 0.00000000e+000 0.00000000e+000 0.00000000e+000

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3.61090619e-184 4.03010737e-241 2.17770951e-108 3.89763811e-083

1.32311991e-027 0.00000000e+000 9.40842852e-001 0.00000000e+000

0.00000000e+000 2.08604295e-142 0.00000000e+000 0.00000000e+000

5.27316052e-002 6.42554248e-003 2.86517770e-051 0.00000000e+000

9.38124897e-070 2.85251971e-239 4.80732643e-276 4.44205501e-078

0.00000000e+000 0.00000000e+000]

[ 0.00000000e+000 7.58568352e-002 1.16307065e-002 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 2.88838131e-217

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 8.46485396e-001

0.00000000e+000 0.00000000e+000 9.01284432e-319 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 6.60270621e-002

0.00000000e+000 2.61829627e-214 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000]

[ 1.34746593e-151 0.00000000e+000 5.15349439e-002 0.00000000e+000

0.00000000e+000 0.00000000e+000 1.41815062e-041 0.00000000e+000

2.28407504e-170 0.00000000e+000 4.65656177e-242 1.92775866e-257

0.00000000e+000 0.00000000e+000 0.00000000e+000 1.21430383e-032

9.34350802e-001 2.85932139e-153 3.61921686e-003 0.00000000e+000

0.00000000e+000 0.00000000e+000 1.31522063e-194 0.00000000e+000

6.68323291e-258 2.52490602e-171 1.04950368e-002 0.00000000e+000

0.00000000e+000 0.00000000e+000]

[ 3.59620205e-002 0.00000000e+000 7.41357449e-011 0.00000000e+000

2.76112524e-003 1.96068483e-052 1.51350811e-001 2.26614498e-113

8.86917469e-005 2.87953669e-131 3.80195227e-086 2.34116496e-004

4.47833815e-033 0.00000000e+000 2.33207730e-003 1.36850848e-003

1.90062218e-003 7.95130945e-001 7.89205525e-003 0.00000000e+000

1.08488332e-009 6.21541660e-205 1.44299260e-004 0.00000000e+000

8.34725946e-004 8.32591963e-069 2.41336542e-138 2.84905087e-048

5.06885012e-155 0.00000000e+000]

[ 1.94288338e-009 0.00000000e+000 7.13322810e-105 0.00000000e+000

6.69172115e-145 9.69401257e-180 2.89778378e-006 0.00000000e+000

7.08344815e-001 1.36760879e-201 3.39641678e-172 2.91599654e-001

1.00351971e-090 0.00000000e+000 0.00000000e+000 0.00000000e+000

4.60444779e-296 2.90352172e-005 3.72364839e-137 0.00000000e+000

2.35965956e-005 0.00000000e+000 2.47730906e-013 0.00000000e+000

3.37189281e-063 6.12777285e-109 1.21304889e-242 9.30496119e-100

3.56104773e-265 0.00000000e+000]

[ 0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 3.68264080e-060 0.00000000e+000 0.00000000e+000

0.00000000e+000 2.38374237e-025 3.52800747e-155 2.15982629e-297

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 7.84197896e-001

1.24897291e-311 4.18690693e-089 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 7.31582200e-003 0.00000000e+000

2.08486282e-001 0.00000000e+000]

[ 8.24465510e-044 0.00000000e+000 2.00249207e-150 0.00000000e+000

1.18486892e-094 1.96156661e-072 5.94830183e-003 1.73784987e-003

1.68008934e-048 2.67419809e-007 7.26434146e-003 9.32343878e-002

3.49880284e-003 0.00000000e+000 9.35704970e-003 0.00000000e+000

0.00000000e+000 2.20942533e-012 4.11059581e-174 8.08825490e-227

8.67079537e-001 2.28183639e-003 7.71080551e-003 0.00000000e+000

1.80732482e-005 1.41346932e-141 1.10140490e-186 1.86874688e-003

3.15991356e-086 0.00000000e+000]

[ 1.16745750e-169 0.00000000e+000 0.00000000e+000 1.22613098e-003

2.46002507e-003 6.06723225e-002 3.04456396e-202 0.00000000e+000

1.39843384e-225 4.74405063e-002 1.41648281e-065 2.04050829e-187

1.18511638e-020 0.00000000e+000 1.21030018e-076 0.00000000e+000

4.42404439e-312 2.67335211e-231 2.66404525e-256 7.46751248e-085

2.62639756e-003 8.77894571e-001 3.25185795e-106 0.00000000e+000

6.35837409e-132 1.40820445e-003 6.27184249e-003 1.81094109e-160

2.40940959e-022 0.00000000e+000]

[ 1.94670705e-008 0.00000000e+000 1.16073157e-076 0.00000000e+000

2.25904075e-040 5.33571893e-002 4.57849907e-003 2.03014007e-164

7.72053780e-011 1.16710369e-078 4.44917589e-072 3.25705030e-001

1.62733123e-021 0.00000000e+000 6.14128682e-021 7.53946519e-076

1.52250248e-075 1.16189114e-001 3.67353665e-038 0.00000000e+000

1.44743867e-003 3.36430238e-162 4.98722710e-001 0.00000000e+000

2.67393284e-019 3.82831087e-101 6.07748029e-101 1.71034857e-058

5.02320274e-070 0.00000000e+000]

[ 0.00000000e+000 3.47280693e-002 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 4.60566015e-002

0.00000000e+000 0.00000000e+000 0.00000000e+000 1.11970011e-002

0.00000000e+000 0.00000000e+000 0.00000000e+000 9.08018328e-001

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000]

[ 1.14712945e-014 0.00000000e+000 0.00000000e+000 0.00000000e+000

8.23858739e-003 3.98224034e-168 7.32242725e-002 5.34210273e-147

9.88576006e-019 1.19011369e-127 5.87159404e-174 2.83657771e-010

2.02027563e-064 0.00000000e+000 0.00000000e+000 2.49225078e-172

5.24169811e-088 5.60189469e-004 2.44472106e-021 0.00000000e+000

5.94321423e-087 7.65537919e-206 8.66708296e-016 0.00000000e+000

8.99292172e-001 1.76511606e-002 6.79938211e-240 2.57003824e-059

1.03361762e-003 0.00000000e+000]

[ 1.61154250e-021 0.00000000e+000 1.04784754e-112 0.00000000e+000

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4.85921475e-017 5.70497003e-238 5.68611019e-195 6.59761612e-094

3.28299460e-096 0.00000000e+000 0.00000000e+000 0.00000000e+000

1.84250270e-264 1.23097622e-055 1.03407770e-167 0.00000000e+000

1.31711664e-169 1.30092516e-168 7.40398332e-060 0.00000000e+000

7.57551691e-001 2.29835546e-048 3.59513218e-195 1.15771131e-085

1.50057312e-126 0.00000000e+000]

[ 2.43866460e-138 0.00000000e+000 1.77060646e-002 0.00000000e+000

1.83328298e-002 1.92127836e-001 6.08192174e-156 3.10675823e-002

4.31909735e-172 1.84962883e-001 7.81854074e-024 1.21065503e-111

1.22907932e-099 5.26515651e-166 0.00000000e+000 1.63891599e-002

2.11967139e-002 6.35058932e-092 1.77599431e-122 3.57061006e-002

1.09544087e-192 8.33058436e-002 2.86218905e-128 0.00000000e+000

6.90069174e-255 7.01264423e-051 3.99204986e-001 2.55542102e-301

7.26683672e-012 0.00000000e+000]

[ 7.85519535e-073 0.00000000e+000 0.00000000e+000 0.00000000e+000

8.50523030e-107 1.41602737e-090 3.00620162e-031 1.80094004e-050

4.08866189e-071 1.91097187e-096 6.56351279e-065 1.00504634e-025

5.32388910e-014 0.00000000e+000 8.07137704e-061 4.30785643e-219

0.00000000e+000 3.04890992e-050 3.37588797e-217 1.09971571e-259

1.11367678e-007 3.44592962e-058 1.96196609e-036 0.00000000e+000

9.99999889e-001 6.97911742e-141 8.45486009e-100 2.24078109e-032

2.46700447e-148 0.00000000e+000]

[ 2.90831611e-070 0.00000000e+000 0.00000000e+000 0.00000000e+000

7.22963128e-197 9.32981502e-019 9.57122979e-004 0.00000000e+000

2.63387404e-080 3.81991579e-002 1.26593735e-088 1.10931525e-104

3.46494542e-135 0.00000000e+000 1.43260674e-255 0.00000000e+000

0.00000000e+000 7.30188946e-157 1.01570841e-295 7.00811333e-002

6.67648112e-004 9.34967425e-021 1.28065244e-107 0.00000000e+000

4.42426235e-147 2.29326280e-273 6.38928047e-003 2.17399037e-210

8.83705657e-001 0.00000000e+000]

[ 0.00000000e+000 0.00000000e+000 0.00000000e+000 1.07615618e-002

0.00000000e+000 1.27721748e-298 0.00000000e+000 0.00000000e+000

0.00000000e+000 1.04541014e-002 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

0.00000000e+000 3.78393206e-162 0.00000000e+000 0.00000000e+000

0.00000000e+000 0.00000000e+000 0.00000000e+000 0.00000000e+000

1.20016989e-278 9.78784337e-001]]

Means and vars of each hidden state

0th hidden state

mean = [-5.53698663]

var = [ 0.00261346]

1th hidden state

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mean = [-5.38553708]

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29th hidden state

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