%Temperature Forecast (ARIMA)

%load data

clear;

load('O208508baseline.mat'); %This is the baseline data.

BaseLine = A056baselinetelemetry.O208508;

load('O208508temp.mat'); %This is the challenge data

RealTemp = A056challengetelemetry.O208508;

BaseLength = length(BaseLine);% length of vector of baseline values (number of points)

%Estimate ARIMA Model

TempMdl = arima('Constant',0,'D',0,'Seasonality',96,'MALags',10,'SMALags',96);

EstTempMdl = estimate(TempMdl,BaseLine); % Generation of predictive model from baseline data with specified parameters.

[yF,yMSE] = forecast(EstTempMdl,2573,'Y0',BaseLine); % Generates points of forecasted data.

avtemp = mean(BaseLine); % Average temperature, for reference.

sttemp = std(BaseLine); % Standard deviation of baseline temp, for reference.

[E,V,logL] = infer(EstTempMdl, BaseLine);

% Calculates goodness-of-fit statistics.

%Calculate Residuals

Residual = zeros(length(yF),1);close all

% This is an empty vector that will eventually hold the values of the residuals.

for i=1:length(yF)

Residual(i) = RealTemp(i)-yF(i);

% This for-loop populates the Residual vector with residual values.

end

Rmax = max(Residual);

ResidualSq = zeros(BaseLength,1);close all

for i=1:BaseLength

ResidualSq(i) = Residual(i)^2;

% calculates squared value for residuals in the baseline period

end

ResidualSumSq = sum(ResidualSq(1:BaseLength));

% calculates residual sum of squares

ResidualSumSqVal = ResidualSumSq/(BaseLength-1);

ResidualUpper = zeros(length(yF),1);

for i = 1:length(ResidualUpper)

ResidualUpper(i,1) = 3\*sqrt(ResidualSumSqVal);

% This for-loop generates an upper bound line for residuals.

end

ResidualLower = zeros(length(yF),1);

for i = 1:length(ResidualLower)

ResidualLower(i,1) = -1\* ResidualUpper(i,1);

% this for loop creates the lower bound line for residuals

end

% calculate time

TimePre = zeros(BaseLength,1);

StartTime = -1\*(BaseLength/96);

for i = 1:BaseLength

TimePre(i,1) = StartTime + (i/96);

end

TotalLength = length(yF);

PostLength = TotalLength - BaseLength;

TimePost = zeros(PostLength,1);

for i = 1:PostLength

TimePost(i,1) = i/96;

end

TimeTotal = vertcat(TimePre,TimePost);

% Calculate 6 hour residual medians

MedianLength = round(TotalLength/24);

SixhrTempMedian = zeros(MedianLength,1);

SixhrMax = zeros(MedianLength,1);

TimeMedian = zeros(MedianLength,1);

A = 1; % use this to count

for i = 1:MedianLength

B = A+23;

SixhrTempMedian(i,1) = median(Residual(A:B));

SixhrMax(i,1) = max(Residual(A:B));

TimeMedian(i,1) = TimeTotal(A,1);

A = A+24;

end

DailyFeverLength = round(TotalLength/96);

DailyFeverHours = zeros(DailyFeverLength,1);

DailyFeverDuration = zeros(DailyFeverLength,1);

TimeDays = zeros(DailyFeverLength,1);

A = 1;

for i = 1:DailyFeverLength

DailyFeverSum = 0; % initialize to 0

DailyFeverPoints = 0; % initialize to 0

B = A+95;

for z = A:B

if Residual(z,1)> ResidualUpper(z,1);

DailyFeverSum = DailyFeverSum + Residual(z,1);

DailyFeverPoints = DailyFeverPoints + 1;

end

DailyFeverHours(i,1) = DailyFeverSum/4;

DailyFeverDuration(i,1) = DailyFeverPoints/4;

end

TimeDays(i,1) = TimeTotal(A,1);

A = A+95;

End

FeverSum = 0;

FeverPoints = 0;

for i = BaseLength:TotalLength

if Residual(i,1) > ResidualUpper(i,1);

FeverSum = FeverSum + Residual(i,1);

FeverPoints = FeverPoints + 1;

end

end

FeverHours = FeverSum/4;

FeverDuration = FeverPoints/4;

figure;

plot(TimeTotal,Residual,'b','LineWidth',2); % This plots the residuals.

ylim([-6 6]);

hold on;

h1 = plot(TimeTotal,ResidualUpper,'k--','LineWidth',1);

plot(TimeTotal,ResidualLower,'k--','LineWidth',1);

hold off;

%Plot predicted time series over actual data.

figure;

plot(TimeTotal,RealTemp,'r');

hold on;

h1 = plot(TimeTotal,yF,'b');

title('O208508 Temperature ARIMA Forecast and 99% Forecast Interval');

legend(h1,'Forecast','Location','NorthWest');

hold off;

%Plot six hour median residuals

figure;

plot(TimeMedian,SixhrTempMedian,'g','LineWidth',2);

ylim([-6 6]);

hold on;

h1 = plot(TimeTotal,ResidualUpper,'k--','LineWidth',1);

plot(TimeTotal,ResidualLower,'k--','LineWidth',1);

hold off;

T = table(TimeTotal, yF, yMSE, RealTemp, Residual, ResidualUpper, ResidualLower);

filename = 'O208058c.xlsx';

writetable(T,filename)

RSS = {'Residual Sum of Squares'; ResidualSumSq}

xlswrite(filename, RSS, 1, 'H2')

DegF = {'Degrees of Freedom'; BaseLength}

xlswrite(filename, DegF, 1, 'H4')

FevH = {'Fever-Hours'; FeverHours}

xlswrite(filename,FevH,1,'H6')

FevDur = {'Fever Duration'; FeverDuration}

xlswrite(filename,FevDur,1,'H8')

ResMax = {'Residual Max'; Rmax}

xlswrite(filename,ResMax,1,'H10')

ST = table(TimeMedian, SixhrTempMedian, SixhrMax);

writetable(ST, filename, 'Sheet', 2)

RT = table(TimeDays, DailyFeverHours, DailyFeverDuration);

writetable(RT, filename, 'Sheet', 3)