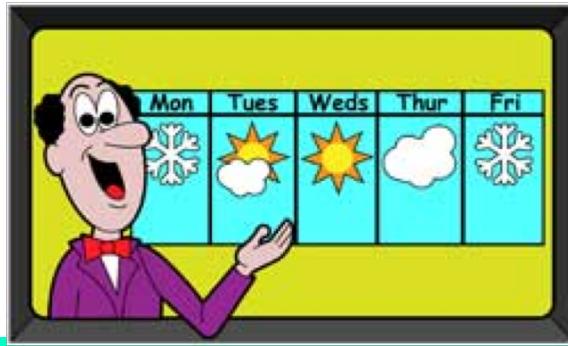


# USA City Temperature Analysis



**ALY6015 Intermediate Final Project  
Northeastern University  
March 29, 2018  
Mohit Abbi, PaoTing Kung**

# Introduction

- Weather is changeable in Boston.
- We use USAtemp.csv dataset to forecast five USA cities temperature trend.
- Temperature changes depend on season.
- Density plots, Time Series decomposition graph, Prediction plot (ARIMA and auto.arima).



# Objective

- Generate future weather trend to help company make decisions.
  - Product quantities, Price, Plant fruits, Build amusement park in which state
- Government use weather predictions to take emergency procedures.
- School use weather predictions to launch alert.



# Descriptive Analysis and Summary of Data

Minimum Temperatures of 5 cities of USA from January, 2000 to October, 2012

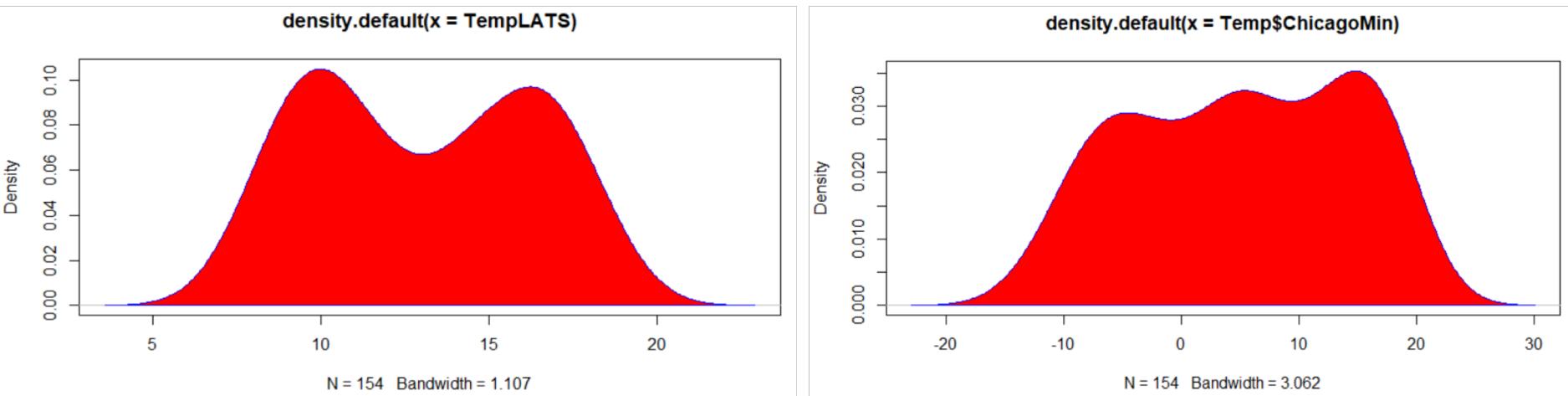
```
> summary(Temp)
      Date   LosAngelesMin       NYMin      HoustonMin      ChicagoMin
2000M01: 1  Min.   : 6.90  Min.   :-7.400  Min.   : 2.600  Min.   :-13.800
2000M02: 1  1st Qu.:10.10  1st Qu.:-0.200  1st Qu.: 9.425  1st Qu.: -3.150
2000M03: 1  Median  :12.75  Median  : 8.400  Median  :15.200  Median  : 5.600
2000M04: 1  Mean    :13.04  Mean    : 8.112  Mean    :15.322  Mean    : 5.131
2000M05: 1  3rd Qu.:16.07  3rd Qu.:16.400  3rd Qu.:21.775  3rd Qu.:13.700
2000M06: 1  Max.    :19.60  Max.    :21.900  Max.    :25.400  Max.    : 20.900
(Other):148
      SeattleMin
Min.   :-0.400
1st Qu.: 2.950
Median  : 6.400
Mean   : 6.842
3rd Qu.:10.900
Max.   :14.200

> str(TempLATS)
Time-Series [1:154] from 2000 to 2013: 10 10.1 10.1 12.5 14.2 ...
.
> str(TempNYts)
Time-Series [1:154] from 2000 to 2013: -5.6 -2.1 1.6 4.7 11.1 15.9 18.1 18.5 14.7 8.3 ...
> str(TempHousts)
Time-Series [1:154] from 2000 to 2013: 7.4 9.3 12.5 12.6 20.4 21.7 22.2 22 19.1 15.2 ...
> str(Tempchits)
Time-Series [1:154] from 2000 to 2013: -8.1 -2.6 0.8 2.7 10.4 13.8 16.4 16.7 12 7.6 ...
> str(Tempseats)
```

Warning message:

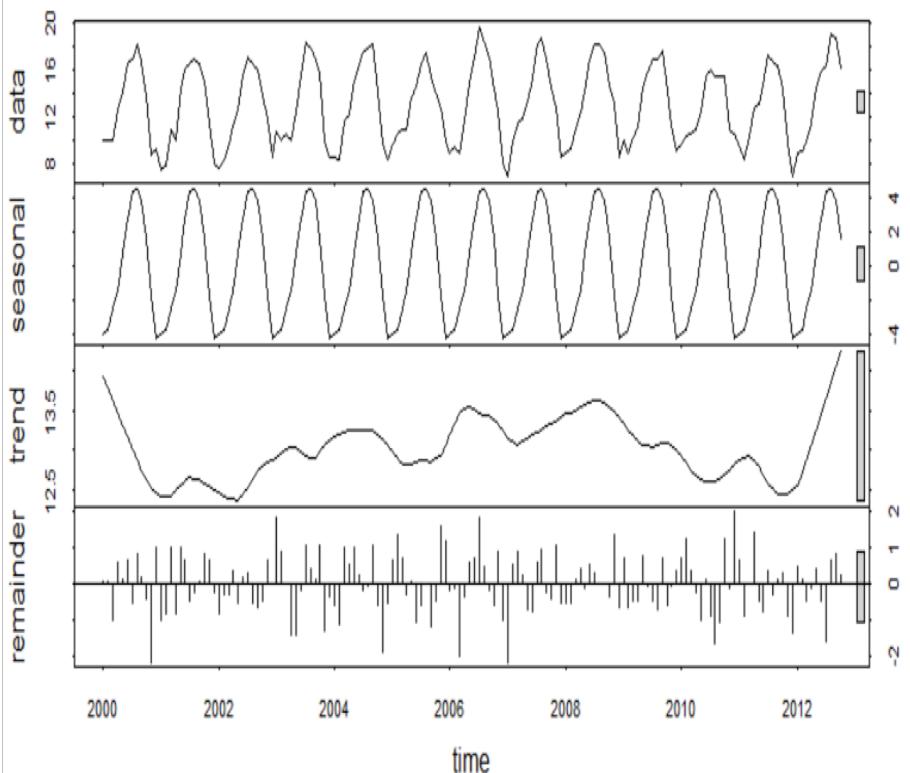
In adf.test(TempLATS) : p-value smaller than printed p-value

# Los Angeles and Chicago Density Plot

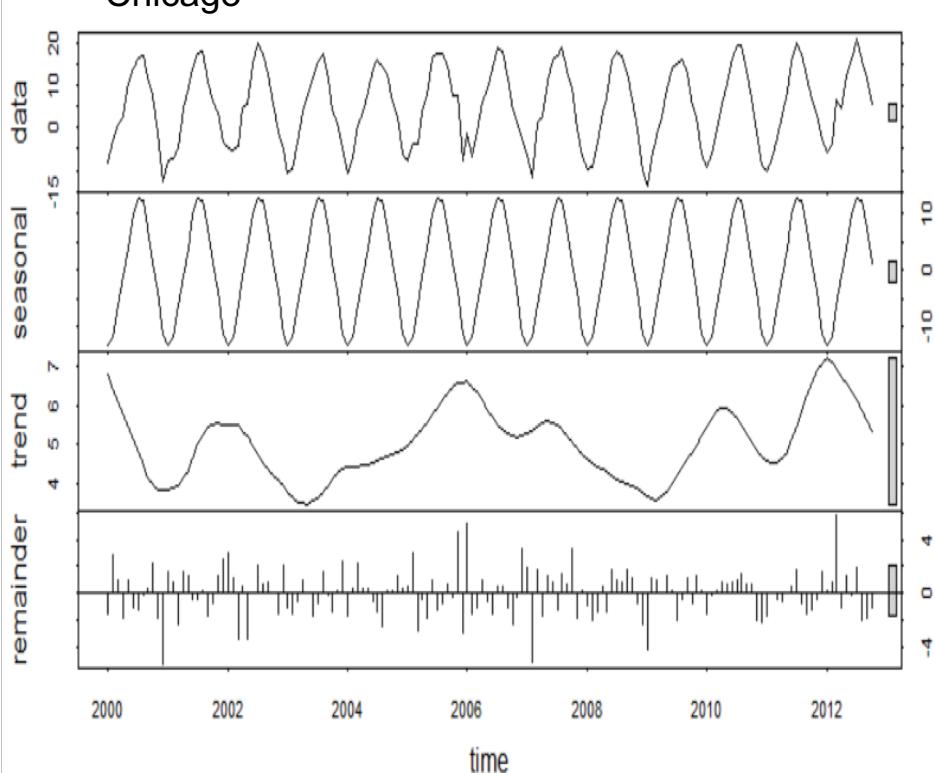


# Los Angeles and Chicago Decomposition of Time Series

Los Angeles

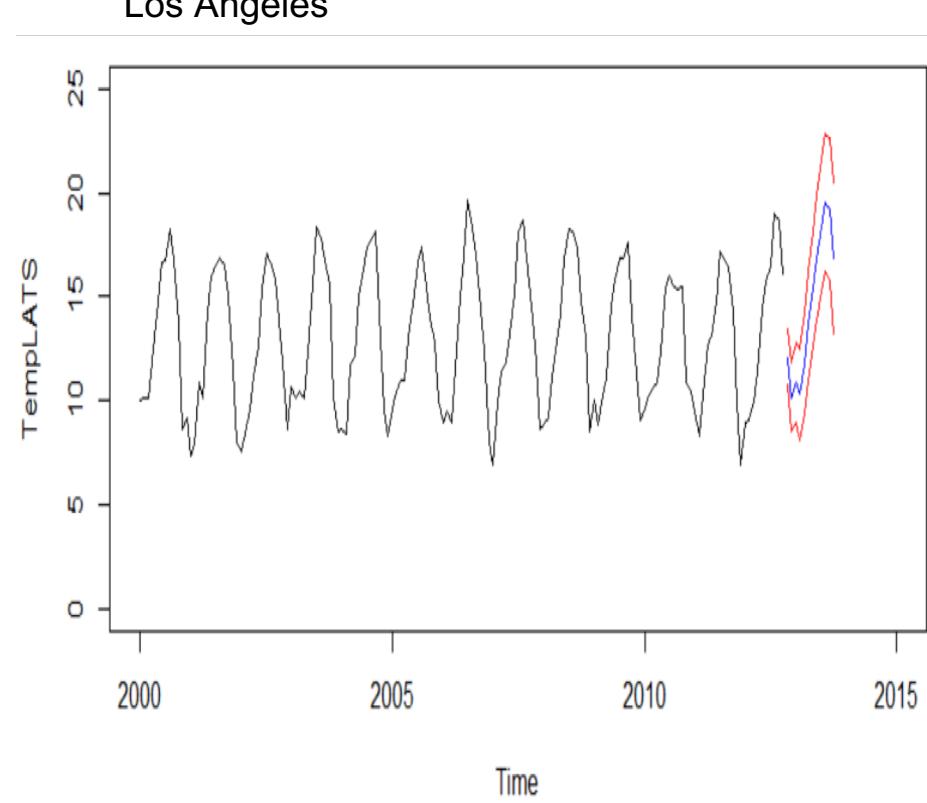


Chicago

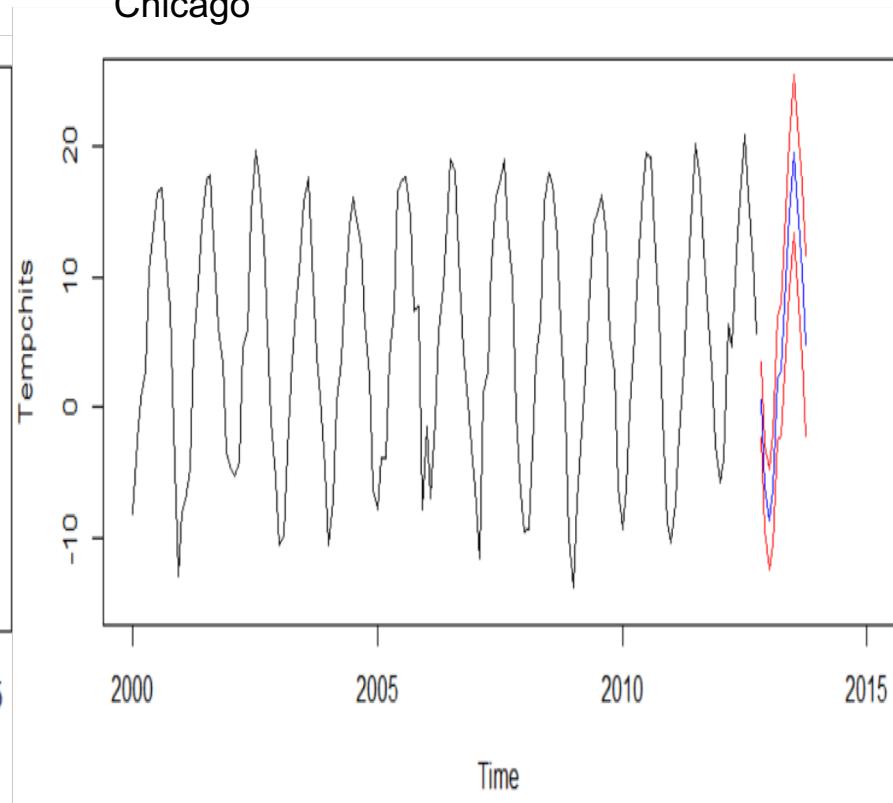


# Los Angeles and Chicago Time Series ARIMA Prediction

Los Angeles



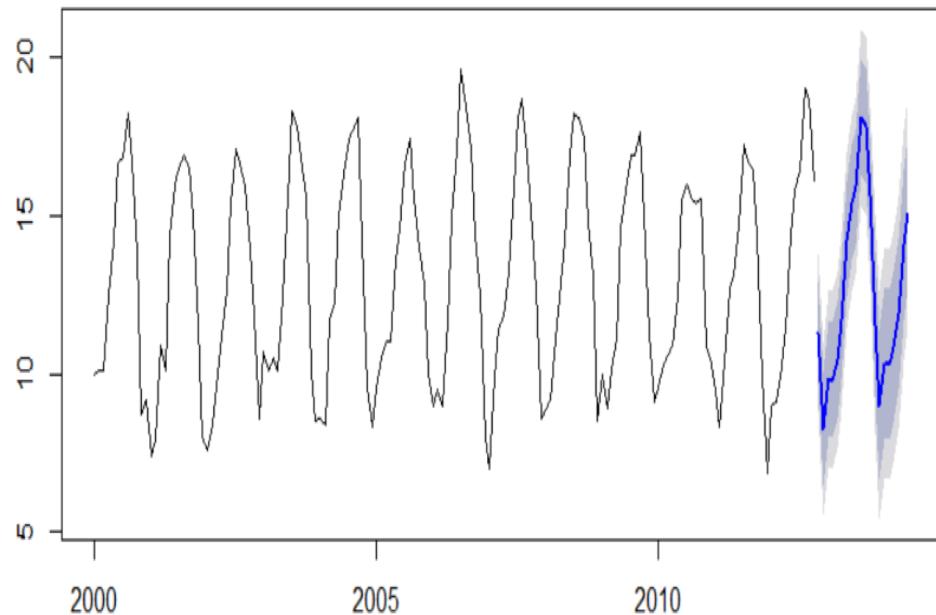
Chicago



# Los Angeles Time Series Auto-ARIMA Prediction

Los Angeles

Forecasts from ARIMA(1,0,0)(1,0,0)[12] with non-zero mean



> `torecLA`

		Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
Nov	2012	11.297546	9.680639	12.91445	8.824700	13.77039
Dec	2012	8.268660	6.492495	10.04482	5.552251	10.98507
Jan	2013	9.821592	8.014259	11.62892	7.057515	12.58567
Feb	2013	9.804627	7.990919	11.61834	7.030800	12.57845
Mar	2013	10.435144	8.620122	12.25017	7.659306	13.21098
Apr	2013	11.682940	9.867646	13.49823	8.906687	14.45919
May	2013	14.210969	12.395618	16.02632	11.434630	16.98731
Jun	2013	15.390830	13.575468	17.20619	12.614473	18.16719
Jul	2013	15.896372	14.081007	17.71174	13.120011	18.67273
Aug	2013	18.094704	16.279339	19.91007	15.318342	20.87107
Sep	2013	17.840539	16.025174	19.65590	15.064177	20.61690
Oct	2013	15.641125	13.825760	17.45649	12.864764	18.41749
Nov	2013	11.578851	9.305875	13.85183	8.102633	15.05507
Dec	2013	9.016809	6.660304	11.37331	5.412845	12.62077
Jan	2014	10.330350	7.956946	12.70375	6.700542	13.96016
Feb	2014	10.315992	7.939111	12.69287	6.680866	13.95112
Mar	2014	10.849316	8.471717	13.22692	7.213092	14.48554
Apr	2014	11.904771	9.527024	14.28252	8.268320	15.54122
May	2014	14.043121	11.665343	16.42090	10.406623	17.67962
Jun	2014	15.041115	12.663330	17.41890	11.404607	18.67762

# Hypothesis Test (T-test)

One Sample t-test

```
data: Temp$LosAngelesMin
t = 3.8392, df = 153, p-value = 9.013e-05
alternative hypothesis: true mean is greater than 12
95 percent confidence interval:
 12.59297      Inf
sample estimates:
mean of x
13.04221
```

One Sample t-test

```
data: Temp$LosAngelesMin
t = 3.8392, df = 153, p-value = 0.9999
alternative hypothesis: true mean is less than 12
95 percent confidence interval:
 -Inf 13.49145
sample estimates:
mean of x
13.04221
```

# Conclusion

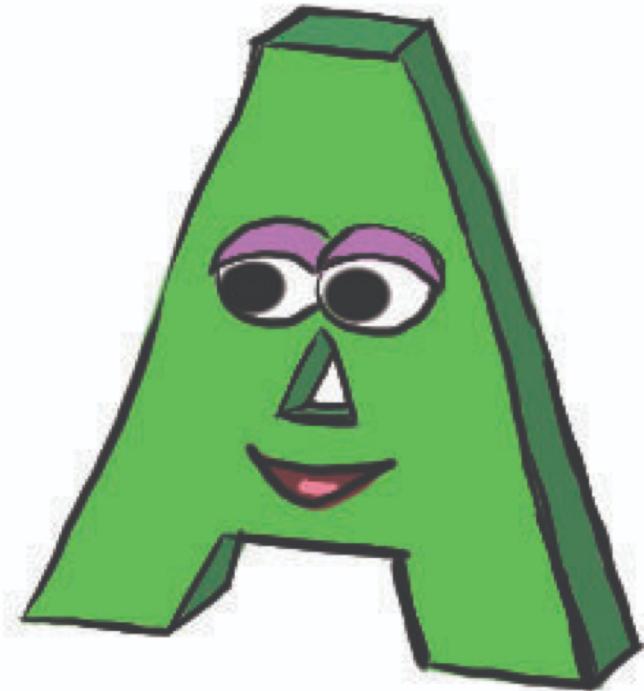
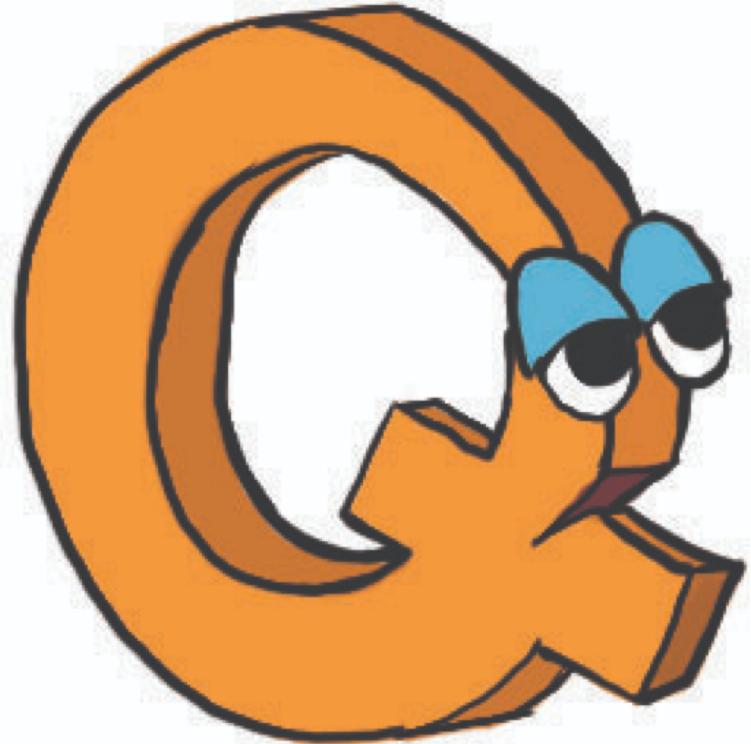
- Los Angeles & Chicago temperature trend won't change dramatically in next years .
- Temperature range in Los Angeles between 5 to 25.
- Temperature range in Chicago between -15 to 25.
- People should consider weather condition in Chicago if they want to travel in winter.
- Residents should aware extreme weather condition in Chicago.

## Limitations/Restrictions

- Prediction might change between the range due to uncertainty.
- The prediction sample is not random sample from the same population
- Unpredictable events like global warming can also affect the temperature trend which can deviate from our original prediction.

## Future Extensions

- Try different time series methods to get more accurate result
- The Box-Jenkins methodology.



Thank You