

Analisis nilai Ekspor dengan Double Exponential Smoothing

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```
library(readxl)
ekspor = read_excel("D:/Users/file lama/a s u s/Documents/ekspor.xlsx",
col_types = c("numeric",
              "text", "numeric"))

## Warning: Coercing text to numeric in C3 / R3C3: '309141204.60'
## Warning: Coercing text to numeric in C4 / R4C3: '275586737.25'
## Warning: Coercing text to numeric in C5 / R5C3: '305911147.42'
## Warning: Coercing text to numeric in C6 / R6C3: '265910871.32'
## Warning: Coercing text to numeric in C7 / R7C3: '245626806.60'
## Warning: Coercing text to numeric in C8 / R8C3: '256969410.38'
## Warning: Coercing text to numeric in C9 / R9C3: '359519434.16'
## Warning: Coercing text to numeric in C10 / R10C3: '291668389.20'
## Warning: Coercing text to numeric in C11 / R11C3: '329453052.98'
## Warning: Coercing text to numeric in C12 / R12C3: '319320442.19'
## Warning: Coercing text to numeric in C13 / R13C3: '236754860.91'
## Warning: Coercing text to numeric in C14 / R14C3: '256234868.49'
## Warning: Coercing text to numeric in C15 / R15C3: '265421447.24'
## Warning: Coercing text to numeric in C16 / R16C3: '245661556.37'
## Warning: Coercing text to numeric in C17 / R17C3: '220060697.85'
## Warning: Coercing text to numeric in C18 / R18C3: '195809680.07'
## Warning: Coercing text to numeric in C19 / R19C3: '252512457.71'
## Warning: Coercing text to numeric in C20 / R20C3: '206612534.96'
## Warning: Coercing text to numeric in C21 / R21C3: '218698714.60'
## Warning: Coercing text to numeric in C22 / R22C3: '251967942.37'
## Warning: Coercing text to numeric in C23 / R23C3: '273146211.49'
```

```
## Warning: Coercing text to numeric in C24 / R24C3: '249092774.61'
## Warning: Coercing text to numeric in C25 / R25C3: '267488250.65'
## Warning: Coercing text to numeric in C26 / R26C3: '282740138.13'
## Warning: Coercing text to numeric in C27 / R27C3: '206314742.91'
## Warning: Coercing text to numeric in C28 / R28C3: '250436443.34'
## Warning: Coercing text to numeric in C29 / R29C3: '222851579.69'
## Warning: Coercing text to numeric in C30 / R30C3: '246782458.83'
## Warning: Coercing text to numeric in C31 / R31C3: '174208755.24'
## Warning: Coercing text to numeric in C32 / R32C3: '221062087.16'
## Warning: Coercing text to numeric in C33 / R33C3: '276864728.70'
## Warning: Coercing text to numeric in C34 / R34C3: '207334259.65'
## Warning: Coercing text to numeric in C35 / R35C3: '283862266.29'
## Warning: Coercing text to numeric in C36 / R36C3: '298504664.52'
## Warning: Coercing text to numeric in C37 / R37C3: '361021446.75'
## Warning: Coercing text to numeric in C38 / R38C3: '395510231.51'
## Warning: Coercing text to numeric in C39 / R39C3: '309463828.12'
## Warning: Coercing text to numeric in C40 / R40C3: '287138405.26'
## Warning: Coercing text to numeric in C41 / R41C3: '378525530.06'
## Warning: Coercing text to numeric in C42 / R42C3: '302800481.70'
## Warning: Coercing text to numeric in C43 / R43C3: '331730921.93'
## Warning: Coercing text to numeric in C44 / R44C3: '387206779.10'
## Warning: Coercing text to numeric in C45 / R45C3: '425426771.74'
## Warning: Coercing text to numeric in C46 / R46C3: '514697644.49'
## Warning: Coercing text to numeric in C47 / R47C3: '491406205.65'
## Warning: Coercing text to numeric in C48 / R48C3: '600258323.35'
## Warning: Coercing text to numeric in C49 / R49C3: '377813313.17'
## Warning: Coercing text to numeric in C50 / R50C3: '437562251.32'
## Warning: Coercing text to numeric in C51 / R51C3: '332369611.79'
```

```
## Warning: Coercing text to numeric in C52 / R52C3: '331010737.44'
## Warning: Coercing text to numeric in C53 / R53C3: '585043013.71'
## Warning: Coercing text to numeric in C54 / R54C3: '374797256.92'
## Warning: Coercing text to numeric in C55 / R55C3: '297759149.84'
## Warning: Coercing text to numeric in C56 / R56C3: '526886973.00'
## Warning: Coercing text to numeric in C57 / R57C3: '430902594.96'
## Warning: Coercing text to numeric in C58 / R58C3: '674546010.98'
## Warning: Coercing text to numeric in C59 / R59C3: '551999744.08'
## Warning: Coercing text to numeric in C60 / R60C3: '639769026.49'
## Warning: Coercing text to numeric in C61 / R61C3: '441657842.58'
## Warning: Coercing text to numeric in C62 / R62C3: '419506909.06'
View(ekspor)
```

##Panggil Data dan Informasi Data

```
statistika = summary(ekspor$Ekspor)
statistika

##      Min.   1st Qu.   Median     Mean   3rd Qu.     Max.
## 174208755 251585068 298131907 332939044 380695842 674546011

sd(ekspor$Ekspor)

## [1] 116611886

tabell= (statistika)
tabell

##      Min.   1st Qu.   Median     Mean   3rd Qu.     Max.
## 174208755 251585068 298131907 332939044 380695842 674546011
```

Terdapat nilai ekspor terkecil adalah 174208755, nilai ekspor terbesar adalah 674546011 dengan rata rata nilai ekspor sebesar 332939044 pada tahun 2018

##Memanggil data historis Nilai Ekspor pada Database Ekspor

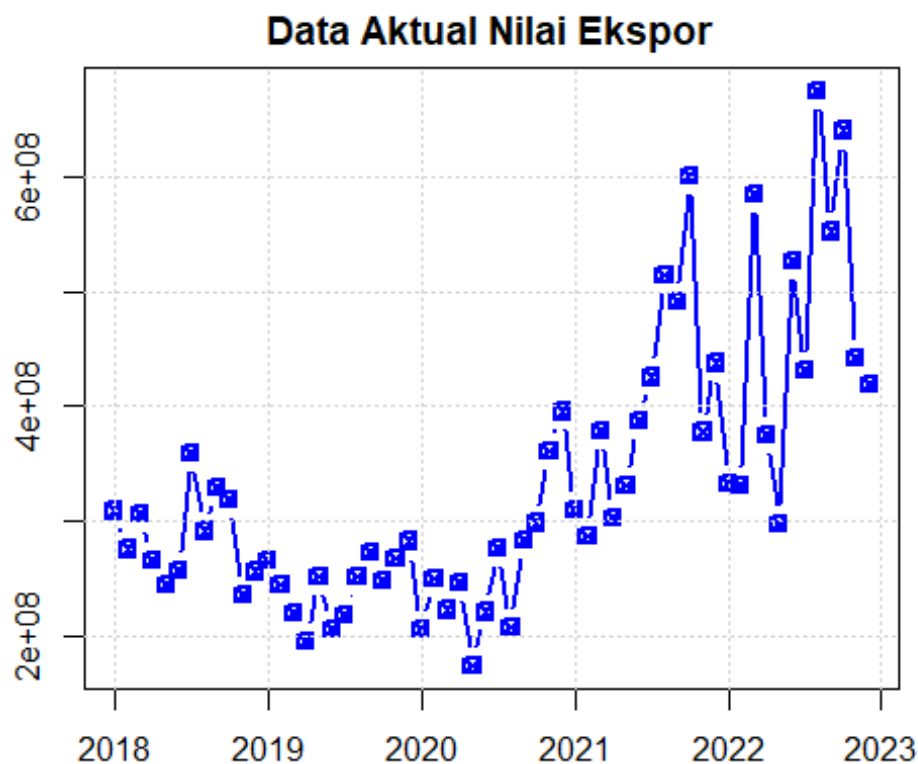
```
ntp.ts = ts(ekspor$Ekspor, start = c(2018,1), frequency = 12)
ntp.ts
```

	Jan	Feb	Mar	Apr	May	Jun	Jul
2018	309141205	275586737	305911147	265910871	245626807	256969410	359519434
2019	265421447	245661556	220060698	195809680	252512458	206612535	218698715
2020	206314743	250436443	222851580	246782459	174208755	221062087	276864729
2021	309463828	287138405	378525530	302800482	331730922	387206779	425426772
2022	332369612	331010737	585043014	374797257	297759150	526886973	430902595

	Aug	Sep	Oct	Nov	Dec
2018	291668389	329453053	319320442	236754861	256234868
2019	251967942	273146211	249092775	267488251	282740138
2020	207334260	283862266	298504665	361021447	395510232
2021	514697644	491406206	600258323	377813313	437562251
2022	674546011	551999744	639769026	441657843	419506909

##Visualisasi data nilai ekspor pada tahun 2018-2023

```
par(mar = c(2,2,2,2))
plot.ts(ntp.ts, col = "blue", lwd = 2, type = "b", pch = 7, main = "Data
Aktual Nilai Ekspor")
grid()
```



Nilai ekspor mengalami volatilitas sepanjang tahun 2018-2023 dengan volatilitas tertinggi terjadi pada tahun 2021 sampai 2023. Dapat dilihat pada grafik nilai ekspor ditahun tersebut mengalami kenaikan yang cukup signifikan dibandingkan tahun sebelumnya dan dapat dilihat bahwa nilai ekspor dari tahun ke tahun memiliki tren naik yang artinya setiap tahun nilai ekspor bertambah secara positif.

##Mendeteksi Apakah data memiliki tren atau musiman

```
tren =decompose(ntp.ts)
tren
```

```
## $x
```

##		Jan	Feb	Mar	Apr	May	Jun	Jul
##	2018	309141205	275586737	305911147	265910871	245626807	256969410	359519434
##	2019	265421447	245661556	220060698	195809680	252512458	206612535	218698715
##	2020	206314743	250436443	222851580	246782459	174208755	221062087	276864729
##	2021	309463828	287138405	378525530	302800482	331730922	387206779	425426772
##	2022	332369612	331010737	585043014	374797257	297759150	526886973	430902595

##		Aug	Sep	Oct	Nov	Dec
##	2018	291668389	329453053	319320442	236754861	256234868
##	2019	251967942	273146211	249092775	267488251	282740138
##	2020	207334260	283862266	298504665	361021447	395510232
##	2021	514697644	491406206	600258323	377813313	437562251
##	2022	674546011	551999744	639769026	441657843	419506909

```
##
```

```
## $seasonal
```

##		Jan	Feb	Mar	Apr	May	Jun	Jul
##	2018	-36090775	-40653280	26098636	-51130300	-72597361	-5043245	22577520
##	2019	-36090775	-40653280	26098636	-51130300	-72597361	-5043245	22577520
##	2020	-36090775	-40653280	26098636	-51130300	-72597361	-5043245	22577520
##	2021	-36090775	-40653280	26098636	-51130300	-72597361	-5043245	22577520
##	2022	-36090775	-40653280	26098636	-51130300	-72597361	-5043245	22577520

##		Aug	Sep	Oct	Nov	Dec
##	2018	18047871	42612789	60898050	3196188	32083906
##	2019	18047871	42612789	60898050	3196188	32083906
##	2020	18047871	42612789	60898050	3196188	32083906
##	2021	18047871	42612789	60898050	3196188	32083906
##	2022	18047871	42612789	60898050	3196188	32083906

```
##
```

```
## $trend
```

##		Jan	Feb	Mar	Apr	May	Jun	Jul
##	2018	NA	NA	NA	NA	NA	NA	285853112
##	2019	259051589	251529873	247529570	242257298	240611703	242996648	241638254
##	2020	241156092	241719939	240306705	242812036	248768081	257364051	266360684
##	2021	324520380	343517273	364971745	386192478	399465209	401917037	404623612
##	2022	441480764	448369272	457554351	461725361	466031829	467939712	NA

##		Aug	Sep	Oct	Nov	Dec
##	2018	282784573	277960589	271462604	268828623	267017322
##	2019	239374429	239689669	241929822	240791033	238130444
##	2020	272187811	280203474	289023973	297921481	311407600
##	2021	407406034	417838943	429443704	431028079	435432596
##	2022	NA	NA	NA	NA	NA

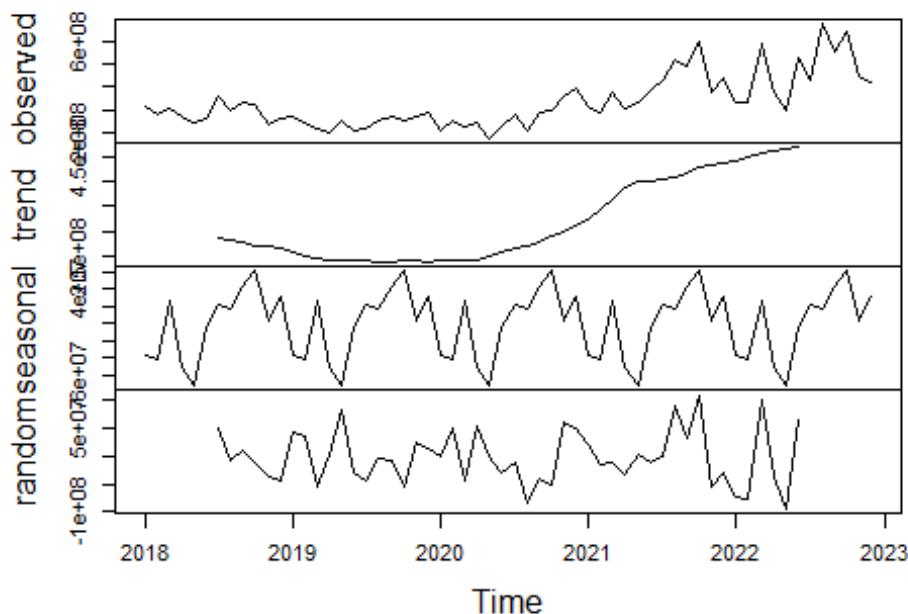
```
##
```

```
## $random
```

##		Jan	Feb	Mar	Apr	May	Jun	Jul
##	2018	NA	NA	NA	NA	NA	NA	51088802
##	2019	42460634	34784963	-53567508	4682682	84498115	-31340868	-45517060
##	2020	1249426	49369784	-43553762	55100723	-1961965	-31258720	-12073476

```
## 2021 21034223 -15725588 -12544852 -32261696 4863074 -9667013 -1774361
## 2022 -73020377 -76705254 101390026 -35797804 -95675319 63990506 NA
##      Aug      Sep      Oct      Nov      Dec
## 2018 -9164055  8879675 -13040211 -35269950 -42866359
## 2019 -5454357 -9156247 -53735097 23501030 12525789
## 2020 -82901422 -38953997 -51417358 59903778 52018726
## 2021 89243740 30954474 109916570 -56410953 -29954251
## 2022      NA      NA      NA      NA      NA
##
## $figure
## [1] -36090775 -40653280 26098636 -51130300 -72597361 -5043245 22577520
## [8] 18047871 42612789 60898050 3196188 32083906
##
## $type
## [1] "additive"
##
## attr(,"class")
## [1] "decomposed.ts"
plot(tren)
```

Decomposition of additive time series



dapat dilihat pada grafik dekomposisi bahwa data memiliki trend naik secara positif dan pada tabel seasonal atau musiman data memiliki karakteristik atau pola yang berulang sama dan tidak ada perbedaan pada waktu tertentu oleh karena itu data nilai ekspor tidak memiliki musim tertentu

```

library(stats)
hwntp1 =HoltWinters(ntp.ts, gamma = FALSE )
hwntp1

## Holt-Winters exponential smoothing with trend and without seasonal
component.
##
## Call:
## HoltWinters(x = ntp.ts, gamma = FALSE)
##
## Smoothing parameters:
##  alpha: 0.4614293
##  beta : 0.1001753
##  gamma: FALSE
##
## Coefficients:
##      [,1]
## a 488317592
## b   3047853

hwntp1$fitted

##           xhat      level      trend
## Mar 2018 242032270 275586737 -33554467.4
## Apr 2018 240906113 271507855 -30601741.4
## May 2018 222998115 252444041 -29445925.8
## Jun 2018 205039715 233439656 -28399941.1
## Jul 2018 203002045 229001597 -25999552.0
## Aug 2018 256459032 275223752 -18764719.8
## Sep 2018 255568452 272705660 -17137208.6
## Oct 2018 275938991 289660970 -13721979.8
## Nov 2018 284239739 295956463 -11716723.2
## Dec 2018 248417170 262328826 -13911655.9
## Jan 2019 238474193 252024485 -13550292.0
## Feb 2019 238603758 250908445 -12304686.8
## Mar 2019 229881985 241860433 -11978448.4
## Apr 2019 212917729 225350155 -12432425.9
## May 2019 191800349 205023574 -13223225.3
## Jun 2019 209397814 219814694 -10416879.5
## Jul 2019 197566979 208112605 -10545625.8
## Aug 2019 197748945 207317781 -9568836.1
## Sep 2019 215704551 222767178 -7062626.7
## Oct 2019 237802362 242209815 -4407453.5
## Nov 2019 239126521 243012089 -3885567.5
## Dec 2019 249638874 252213454 -2574579.9
## Jan 2020 263868254 264912767 -1044512.9
## Feb 2020 233606522 237311378 -3704856.2
## Mar 2020 238445428 241372341 -2926912.9
## Apr 2020 227602249 231249970 -3647720.2
## May 2020 233691422 236452560 -2761137.6

```

```
## Jun 2020 200733724 206244378 -5510653.9
## Jul 2020 205542827 210113826 -4570999.2
## Aug 2020 237178613 238452841 -1274228.2
## Sep 2020 220753806 223407554 -2653748.3
## Oct 2020 250137264 249873898 263366.1
## Nov 2020 274954491 272455399 2499092.3
## Dec 2020 321145741 314668305 6477436.1
## Jan 2021 365374542 355459694 9914847.3
## Feb 2021 346906142 339575701 7330440.3
## Mar 2021 323895305 319327558 4567746.9
## Apr 2021 356196255 349103290 7092964.9
## May 2021 336182690 331557882 4624808.0
## Jun 2021 338547544 334128514 4419030.3
## Jul 2021 367668586 361000340 6668246.2
## Aug 2021 403657955 394319904 9338050.4
## Sep 2021 469365649 454894919 14470729.5
## Oct 2021 495025335 479535807 15489528.3
## Nov 2021 563936717 543582918 20353799.5
## Dec 2021 489804392 478053928 11750464.0
## Jan 2022 475033971 465698339 9335632.4
## Feb 2022 411945598 409204458 2741140.2
## Mar 2022 373599905 374599883 -999978.6
## Apr 2022 479939677 471165947 8773730.5
## May 2022 435337531 431423886 3913645.7
## Jun 2022 369409084 371854837 -2445753.2
## Jul 2022 446907471 442073994 4833477.1
## Aug 2022 443616023 439522352 4093670.5
## Sep 2022 564942019 550173882 14768137.7
## Oct 2022 573139971 558970075 14169896.2
## Nov 2022 621134314 603884568 17249746.0
## Dec 2022 547272272 538318615 8953657.1
```

#Dapat dilihat bahwa nilai dari alpha berada jauh dari 0 yaitu sebesar 0.4 yang artinya data cukup responsif terhadap data terbaru dan nilai beta sebesar 0.1 yang artinya data mengalami kenaikan secara bertahap atau perlahan sehingga cocok untuk peramalan jangka panjang

##Peramalan Nilai Ekspor

```
library(forecast)
```

```
## Registered S3 method overwritten by 'quantmod':
## method from
## as.zoo.data.frame zoo
```

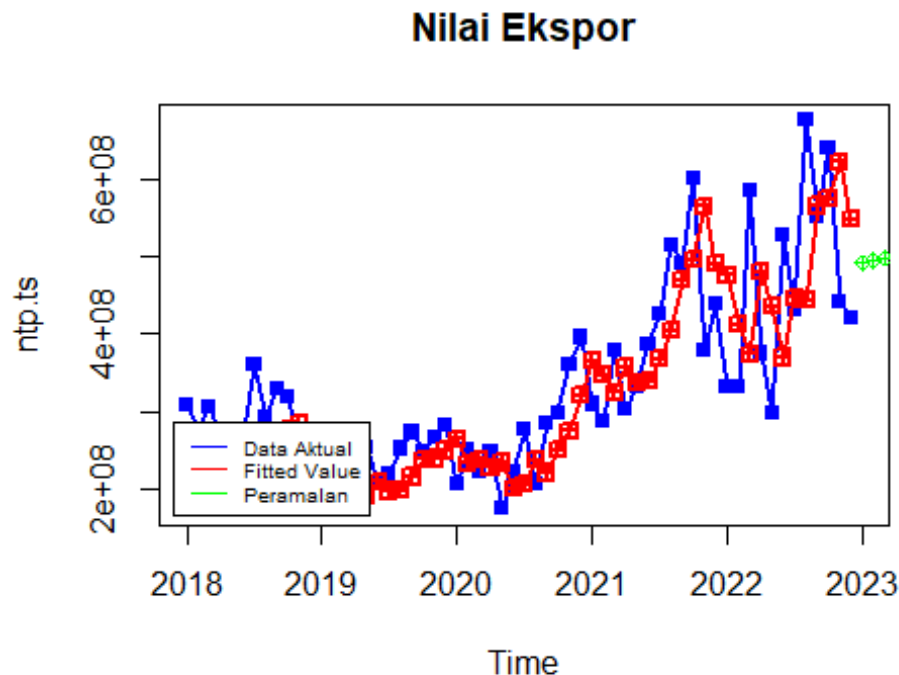
```
prediksi1 = forecast(object = hwntp1, h = 5)
prediksi2 = predict(hwntp1,5)
prediksi2
```

```
## Jan Feb Mar Apr May
## 2023 491365445 494413299 497461152 500509006 503556859
```


#Hasil dari peramalan 5 periode menunjukkan bahwa nilai ekspor akan terus naik ke arah positif secara perlahan namun nilai tersebut merupakan penurunan apabila dibandingkan dengan data aktual pada periode terakhir

```
#plot data aktual dan hasil peramalan
plot(ntp.ts, main = "Nilai Ekspor", lwd = 2, col = "blue", xlim =
c(2018,2023), type = "o", pch = 15)
limitdate = end(ntp.ts)[2]-(end(ntp.ts)[2]-1)/frequency(ntp.ts)
abline(v=limitdate, lty=4)
lines(hwntp1$fitted[,1], lwd = 2, col="red", type = "o", pch=12)
lines(prediksi2, col="green", type = "o", pch = 10)

#menambahkan Legend
legend("bottomleft", legend = c("Data Aktual", "Fitted Value", "Peramalan"),
col = c("blue", "red", "green"), lty = 1, cex = 0.6, inset = 0.02)
```



#Garis biru merupakan nilai aktual dari data nilai ekspor sedangkan garis merah merupakan nilai ramalan dari hasil pemulusan metode DES dan garis hijau adalah nilai prediksi dari 5 periode yang akan datang. Dapat dilihat bahwa garis biru dan merah cukup sama yang berarti kesalahan pada peramalan juga cenderung kecil dan hasil prediksi untuk 5 periode kedepan dapat dikategorikan akurat

##Perhitungan Kesalahan

```
accuracy(hwntp1$fitted[,1],ntp.ts)

##          ME          RMSE          MAE          MPE          MAPE          ACF1 Theil's
U
```

```
## Test set 13652581 83347587 63793078 2.413582 18.13363 -0.02636507  
0.9472367
```

```
sse1 = hwntp1$SSE  
sse1
```

```
## [1] 4.029156e+17
```

```
mse1 = hwntp1$SSE/length(ekspor$Ekspor)  
mse1
```

```
## [1] 6.71526e+15
```

#Dapat dilihat bahwa nilai MAPE yang diperoleh adalah 18 yang artinya nilai kesalahan pada peramalan ini kecil dan hasil peramalan dapat dikategorikan sangat baik

##Nilai Ekspor dari 2018 hingga 2023 mengalami kenaikan kearah positif dan dengan proyek ini dapat dilihat bahwa dalam 5 periode kedepan nilai ekspor juga akan terus bertumbuh naik oleh karena itu diharapkan bagi masyarakat untuk dapat mempertahankan faktor faktor yang membuat nilai ekspor bertumbuh secara positif dan diharapkan proyek ini dapat menjadi bagi masyarakat dalam mengambil langkah untuk mempertahankan pertumbuhan nilai ekspor