Lampiran 1. Data Cuaca Bulan Januari 2017 Stasiun Klimatologi BMKG Karangploso Kota Malang

Data Intensitas Radiasi Matahari Bulan Januari 2017

Tgl	Intensitas Radiasi Matahari (W/m^2)											
	06-07	**07-08**	**08-09**	**09-10**	**10-11**	**11-12**	**12-13**	**13-14**	**14-15**	**15-16**	**16-17**	**17-18**
1	83.8	435.4	424.3	766.9	551.8	416.4	216.6	624.2	327.2	99.5	47.2	11.9
2	149.3	202.9	284.1	433.9	571.1	300.8	591.9	490.0	517.4	382.2	152.2	20.3
3	195.7	273.3	436.8	461.1	840.2	531.1	212.1	451.8	260.8	176.2	125.9	27.1
4	195.7	401.8	436.8	461.1	840.2	531.1	212.1	451.8	260.8	176.2	125.9	27.1
5	135.6	225.7	558.7	828.5	538.9	894.1	398.6	278.7	158.9	100.6	39.4	9.2
6	92.9	225.7	558.7	828.5	538.9	894.1	398.6	278.7	158.9	100.6	39.4	9.2
7	120.7	233.8	420.5	808.2	804.6	837.4	390.1	424.8	71.8	82.2	67.8	24.9
8	173.5	418.7	664.3	562.5	783.8	873.7	620.2	809.1	706.2	491.1	159.1	32.6
9	183.0	425.6	635.5	827.9	916.3	534.1	136.8	508.0	400.1	181.0	22.5	4.9
10	193.6	444.7	636.3	821.2	717.3	458.2	954.4	338.1	73.5	108.6	47.7	9.3
11	114.2	411.3	596.9	706.6	652.1	991.5	886.2	594.7	150.3	12.3	3.6	1.9
12	155.4	404.0	674.1	631.0	676.7	269.1	221.7	351.2	365.6	87.9	46.0	6.2
13	83.3	387.8	506.1	580.5	661.4	851.1	608.3	313.7	357.5	153.4	34.0	8.7
14	35.8	175.4	308.4	611.1	916.7	784.2	420.8	606.0	371.0	114.4	126.2	34.1
15	73.5	107.5	275.1	357.6	362.3	436.7	556.6	438.2	375.6	165.7	43.3	28.4
16	116.6	144.9	284.5	372.8	635.4	748.8	423.2	226.1	147.4	51.0	78.9	13.0
17	93.6	359.1	630.4	669.5	491.5	462.5	670.0	545.9	296.9	84.4	5.4	2.4
18	139.8	273.3	421.2	757.9	720.3	646.8	758.7	339.2	311.9	162.1	64.6	24.4
19	67.5	293.3	484.7	492.3	624.3	865.7	175.6	252.3	90.6	48.8	70.8	13.5
20	149.6	274.7	533.0	530.0	526.4	583.3	682.0	612.0	370.1	71.3	66.6	25.2
21	170.0	438.2	598.6	773.1	883.6	307.7	117.6	27.8	53.7	87.8	45.8	22.5
22	111.0	272.4	520.2	774.6	910.0	534.7	355.8	189.9	152.3	78.5	44.7	16.0
23	180.7	271.5	528.6	709.8	479.1	250.8	138.3	149.1	97.5	77.3	96.1	16.1
24	112.4	459.4	647.8	723.8	514.5	686.7	602.9	820.2	308.8	97.9	11.1	2.4
25	85.0	177.5	490.4	570.2	698.5	691.0	419.4	151.0	68.7	15.2	11.7	4.3
26	146.3	271.2	369.5	448.8	805.7	716.8	535.3	527.3	210.2	104.5	18.5	9.9
27	93.3	420.1	709.9	819.7	883.2	111.9	988.5	730.2	559.4	107.3	21.2	7.2
28	102.9	282.5	447.5	544.0	649.1	494.2	371.3	397.1	132.1	139.8	39.9	5.2
29	69.7	219.0	167.2	232.7	438.7	607.0	314.6	126.9	104.9	59.4	9.1	3.3
30	70.6	224.2	480.7	528.4	701.7	861.8	619.6	433.3	348.7	230.9	126.4	27.6
31	50.5	255.3	298.1	443.1	360.7	351.2	325.5	226.8	142.6	156.1	81.9	19.4

Data Suhu Bulan Januari 2017

Tgl	Data Suhu Tiap Jam (ºC)											
	07.00	**08.00**	**09.00**	**10.00**	**11.00**	**12.00**	**13.00**	**14.00**	**15.00**	**16.00**	**17.00**	**18.00**
1	23.4	25.2	25.6	27.2	27.4	27.6	27.2	27.8	25.0	23.6	23.4	23.4
2	22.4	23.4	24.2	25.2	25.4	27.0	28.2	26.4	27.2	25.8	24.7	23.8
3	22.6	23.6	25.4	26.4	27.3	24.6	24.2	24.8	25.4	25.6	24.4	23.6
4	23.2	25.0	26.8	27.6	27.8	28.9	27.8	24.1	24.7	25.4	25.4	24.6
5	23.4	24.8	25.6	26.8	27.6	28.6	28.0	25.4	26.4	25.6	23.8	22.5
6	22.8	22.4	26.2	27.2	28.0	28.8	25.8	25.6	26.0	25.8	25.0	24.6
7	22.8	24.2	25.9	27.2	28.6	29.0	27.6	26.0	25.8	24.0	24.4	24.2
8	22.8	25.4	26.8	27.2	27.8	29.2	28.8	30.8	29.6	28.8	26.0	24.6
9	22.8	25.8	26.7	27.8	27.6	27.2	26.2	27.2	26.6	26.6	24.6	24.0
10	23.6	25.6	26.8	28.3	29.0	28.4	29.8	27.2	26.1	25.0	24.6	23.6
11	24.2	26.0	26.6	27.7	28.0	28.4	28.8	28.8	26.4	22.8	22.6	22.4
12	22.8	25.2	26.6	27.2	28.4	27.7	25.2	27.2	25.8	24.2	24.6	23.8
13	23.2	25.0	25.6	26.6	28.0	28.7	28.4	25.9	26.7	23.8	23.8	23.4
14	21.8	22.5	23.6	25.4	27.6	28.8	28.1	29.4	26.0	26.0	23.8	23.6
15	21.0	21.6	22.4	23.6	24.8	25.4	25.8	25.8	26.0	25.4	23.2	23.0
16	22.2	23.2	24.6	25.4	26.6	26.3	24.8	24.6	23.4	22.4	22.5	22.6
17	22.0	24.2	26.0	26.4	26.6	26.1	26.6	26.7	24.4	23.4	21.6	21.8
18	21.8	22.8	24.2	25.8	27.0	27.2	28.0	27.2	27.4	25.8	24.2	24.0
19	23.0	23.8	25.0	26.0	27.0	28.0	26.4	25.4	24.0	23.2	23.0	22.8
20	22.0	23.4	25.1	25.6	26.0	26.9	27.4	27.8	26.8	26.0	25.0	24.4
21	23.2	25.2	27.0	27.6	28.3	27.6	25.2	21.6	22.2	23.2	23.2	23.3
22	22.4	24.0	25.8	26.6	27.8	28.2	25.0	25.0	25.4	24.2	24.2	23.7
23	22.4	24.0	25.5	26.4	25.6	25.0	23.3	23.0	23.0	22.6	21.9	21.8
24	22.4	25.4	26.4	27.2	27.5	27.4	27.4	28.1	27.2	25.8	22.3	22.1
25	22.2	23.7	25.4	26.4	27.2	27.4	26.3	24.1	26.0	23.0	22.6	22.6
26	21.9	23.8	25.4	25.6	26.8	26.6	26.6	26.8	26.0	25.0	22.6	22.7
27	23.0	24.8	27.0	27.6	27.8	28.6	29.4	29.4	29.0	26.2	24.4	23.3
28	23.0	24.4	25.8	26.8	27.4	28.0	27.6	28.4	26.3	24.8	23.2	22.1
29	22.8	23.8	24.4	25.2	26.6	27.6	27.1	23.6	22.6	22.4	21.8	21.7
30	21.4	22.7	24.6	26.4	27.4	27.6	27.6	28.0	28.0	27.4	25.8	24.0
31	21.8	23.4	24.0	25.2	25.8	25.8	25.4	24.0	23.4	23.8	23.6	23.4

Data Lama Penyinaran Matahari Bulan Januari 2017

Tgl	Lama Penyinaran (Menit/60Menit)											
	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
1	0.0	0.8	0.9	0.6	0.9	0.5	0.0	0.3	0.6	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.6	0.5	0.7	0.2	0.0
3	0.1	0.5	0.4	0.6	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0
4	0.4	0.9	0.9	1.0	1.0	1.0	0.7	0.0	0.0	0.1	0.2	0.0
5	0.0	0.1	0.0	0.5	0.8	0.9	0.8	0.0	0.4	0.0	0.0	0.0
6	0.0	00	0.1	1.0	0.5	0.7	0.6	0.1	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.6	0.6	0.7	0.5	0.2	0.0	0.0	0.0	0.0
8	0.0	0.4	1.0	0.6	0.8	1.0	0.7	0.9	0.9	0.8	0.4	0.0
9	0.2	1.0	1.0	1.0	1.0	0.8	0.0	0.5	0.5	0.0	0.0	0.0
10	0.3	1.0	1.0	1.0	1.0	0.6	0.8	0.6	0.0	0.0	0.0	0.0
11	0.5	1.0	1.0	0.9	0.8	1.0	1.0	0.8	0.2	0.0	0.0	0.0
12	0.0	0.3	1.0	0.9	0.9	0.3	0.0	0.0	0.0	0.3	0.0	0.0
13	0.3	1.0	1.0	0.5	0.2	0.5	0.3	0.2	0.1	0.2	0.0	0.0
14	0.0	0.0	0.0	0.3	1.0	0.5	0.5	0.3	0.4	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	0.0	0.0	0.0	0.0
17	0.0	0.0	0.6	0.9	0.4	0.3	0.4	0.4	0.5	0.0	0.0	0.0
18	0.0	0.0	0.2	0.4	1.0	0.6	0.4	0.0	0.1	0.0	0.0	0.0
19	0.3	1.0	0.7	0.4	0.4	1.0	0.2	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.5	0.3	0.0	0.0	0.2	0.2	0.3	0.0	0.0	0.0
21	0.5	1.0	0.7	1.0	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
22	0.1	0.5	0.9	1.0	1.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.3	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	0.5	1.0	1.0	1.0	0.6	0.4	0.0	0.8	0.5	0.0	0.0	0.0
25	0.0	0.2	0.2	0.3	0.4	0.6	0.2	0.0	0.0	0.0	0.0	0.0
26	0.0	0.1	0.1	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
27	0.2	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	0.3	0.0	0.0
28	0.0	0.3	0.5	0.6	0.9	0.6	0.0	0.5	0.0	0.0	0.0	0.0
29	0.2	0.4	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.2	0.2	0.6	0.8	0.4	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Lampiran 2 Listing Program MATLAB

Program Variasi Komposisi Data

```
clear all;
clc
close all;

load Data_BMKG;

Variabel_Bebas=Data_BMKG(:,1:2);
Variabel_TakBebas=Data_BMKG(:,3);

Data_Training_VB1=Variabel_Bebas(1:260,:);
Data_Training_VB2=Variabel_Bebas(1:279,:);
Data_Training_VB3=Variabel_Bebas(1:298,:);
Data_Training_VB4=Variabel_Bebas(1:316,:);
Data_Training_VB5=Variabel_Bebas(1:335,:);
Data_Training_VB6=Variabel_Bebas(1:353,:);

Data_Testing_VB1=Variabel_Bebas(261:372,:);
Data_Testing_VB2=Variabel_Bebas(280:372,:);
Data_Testing_VB3=Variabel_Bebas(299:372,:);
Data_Testing_VB4=Variabel_Bebas(317:372,:);
Data_Testing_VB5=Variabel_Bebas(336:372,:);
Data_Testing_VB6=Variabel_Bebas(354:372,:);

Data_Training_VTB1=Variabel_TakBebas(1:260,:);
Data_Training_VTB2=Variabel_TakBebas(1:279,:);
Data_Training_VTB3=Variabel_TakBebas(1:298,:);
Data_Training_VTB4=Variabel_TakBebas(1:316,:);
Data_Training_VTB5=Variabel_TakBebas(1:335,:);
Data_Training_VTB6=Variabel_TakBebas(1:353,:);

Data_Testing_VTB1=Variabel_TakBebas(261:372,:);
Data_Testing_VTB2=Variabel_TakBebas(280:372,:);
Data_Testing_VTB3=Variabel_TakBebas(299:372,:);
Data_Testing_VTB4=Variabel_TakBebas(317:372,:);
Data_Testing_VTB5=Variabel_TakBebas(336:372,:);
Data_Testing_VTB6=Variabel_TakBebas(354:372,:);

%Membuat Spesifikasi FIS dengan Type Sugeno Output Tunggal
%Menghasilkan sebuah Struktur FIS tipe Sugeno yang digunakan sebagai
%kondisi awal untuk training ANFIS
DataTraining1=[Data_Training_VB1 Data_Training_VTB1]
numMFs1 = [5 5]
mfType1 = char('gaussmf','gaussmf');
DataTraining2=[Data_Training_VB2 Data_Training_VTB2]
numMFs2 = [5 5]
mfType2 = char('gaussmf','gaussmf');
DataTraining3=[Data_Training_VB3 Data_Training_VTB3]
```

```
numMFs3 = [5 5]
mfType3 = char('gaussmf','gaussmf');
DataTraining4=[Data_Training_VB4 Data_Training_VTB4]
numMFs4 = [5 5]
mfType4 = char('gaussmf','gaussmf');
DataTraining5=[Data_Training_VB5 Data_Training_VTB5]
numMFs5 = [5 5]
mfType5 = char('gaussmf','gaussmf');

DataTraining6=[Data_Training_VB6 Data_Training_VTB6]
numMFs6 = [5 5]
mfType6 = char('gaussmf','gaussmf');

%Jumlah MF sebanyak 5 tiap input
%Kurva yang digunakan Gaussian untuk kedua input

Xin1 = Data_Training_VB1;
Xin2 = Data_Training_VB2;
Xin3 = Data_Training_VB3;
Xin4 = Data_Training_VB4;
Xin5 = Data_Training_VB5;
Xin6 = Data_Training_VB6;
Xout1 = Data_Training_VTB1;
Xout2 = Data_Training_VTB2;
Xout3 = Data_Training_VTB3;
Xout4 = Data_Training_VTB4;
Xout5 = Data_Training_VTB5;
Xout6 = Data_Training_VTB6;
fismat1 = genfis2(Xin1,Xout1,0.5);
fismat2 = genfis2(Xin2,Xout2,0.5);
fismat3 = genfis2(Xin3,Xout3,0.5);
fismat4 = genfis2(Xin4,Xout4,0.5);
fismat5 = genfis2(Xin5,Xout5,0.5);
fismat6 = genfis2(Xin6,Xout6,0.5);

%Menghasilkan sebuah FIS Sugeno output tunggal dan mencocokan parameter
%sistem menggunakan input/output training data yang spesifik.
%Struktur FIS otomatis dihasilkan menggunakan grid partitioning

 MaxEpoch=100;
   ErrorGoal=0;
   InitialStepSize=0.01;
   StepSizeDecreaseRate=0.9;
   StepSizeIncreaseRate=1.1;

   MetodePembelajaran=1;
   %0=Backpropagation
   %1=Hybrid

   TrainOptions=[MaxEpoch ...
```

```
        ErrorGoal ...
        InitialStepSize ...
        StepSizeDecreaseRate ...
        StepSizeIncreaseRate];

    DisplayInfo=true;
    DisplayError=true;
    DisplayStepSize=true;
    DisplayFinalResult=true;

   DisplayOptions=[DisplayInfo ...
       DisplayError ...
       DisplayStepSize ...
       DisplayFinalResult];

fis1 = anfis(DataTraining1, fismat1, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis2 = anfis(DataTraining2, fismat2, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis3 = anfis(DataTraining3, fismat3, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis4 = anfis(DataTraining4, fismat4, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis5 = anfis(DataTraining5, fismat5, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis6 = anfis(DataTraining6, fismat6, TrainOptions,DisplayOptions,[],
MetodePembelajaran);

%Iterasi yang dilakukan sebanyak 100
%fis merupakan model ANFIS setelah melakukan proses training

output1 = evalfis(Data_Testing_VB1, fis1);
output2 = evalfis(Data_Testing_VB2, fis2);
output3 = evalfis(Data_Testing_VB3, fis3);
output4 = evalfis(Data_Testing_VB4, fis4);
output5 = evalfis(Data_Testing_VB5, fis5);
output6 = evalfis(Data_Testing_VB6, fis6);

%PERHITUNGAN nilai RMSE dan MAE
Data_Aktual1 = Data_Testing_VTB1
Data_Aktual2 = Data_Testing_VTB2
Data_Aktual3 = Data_Testing_VTB3
Data_Aktual4 = Data_Testing_VTB4
Data_Aktual5 = Data_Testing_VTB5
Data_Aktual6 = Data_Testing_VTB6
Data_Peramalan1 = output1
Data_Peramalan2 = output2
Data_Peramalan3 = output3
Data_Peramalan4 = output4
Data_Peramalan5 = output5
```

```
Data_Peramalan6 = output6
rmse1=sqrt(sum((Data_Aktual1(:)-Data_Peramalan1(:)).^2)/numel(Data_Peramalan1));
rmse2=sqrt(sum((Data_Aktual2(:)-Data_Peramalan2(:)).^2)/numel(Data_Peramalan2));
rmse3=sqrt(sum((Data_Aktual3(:)-Data_Peramalan3(:)).^2)/numel(Data_Peramalan3));
rmse4=sqrt(sum((Data_Aktual4(:)-Data_Peramalan4(:)).^2)/numel(Data_Peramalan4));
rmse5=sqrt(sum((Data_Aktual5(:)-Data_Peramalan5(:)).^2)/numel(Data_Peramalan5));
rmse6=sqrt(sum((Data_Aktual6(:)-Data_Peramalan6(:)).^2)/numel(Data_Peramalan6));
error1=abs(Data_Peramalan1(:)-Data_Aktual1(:));
error2=abs(Data_Peramalan2(:)-Data_Aktual2(:));
error3=abs(Data_Peramalan3(:)-Data_Aktual3(:));
error4=abs(Data_Peramalan4(:)-Data_Aktual4(:));
error5=abs(Data_Peramalan5(:)-Data_Aktual5(:));
error6=abs(Data_Peramalan6(:)-Data_Aktual6(:));
mae1=sum(error1(:))/numel(error1);
mae2=sum(error2(:))/numel(error2);
mae3=sum(error3(:))/numel(error3);
mae4=sum(error4(:))/numel(error4);
mae5=sum(error5(:))/numel(error5);
mae6=sum(error6(:))/numel(error6);

%Plot hasil peramalan dan data aktual

sumbu_X = [1:100]';%Untuk urutan data di sumbu x

figure;
plot(Data_Peramalan1,'b-');
hold on
plot(Data_Aktual1,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 70%-30%');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan2,'b-');
hold on
plot(Data_Aktual2,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 75%-25%');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan3,'b-');
hold on
plot(Data_Aktual3,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 80%-20%');
legend('ANFIS','Actual');
```

```
figure;
plot(Data_Peramalan4,'b-');
hold on
plot(Data_Aktual4,'r-');
xlabel('Data ke-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 85%-15%');
legend('ANFIS','Actual');


figure;
plot(Data_Peramalan5,'b-');
hold on
plot(Data_Aktual5,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 90%-10%');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan6,'b-');
hold on
plot(Data_Aktual6,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation 95%-5%');
legend('ANFIS','Actual');
```

Program Variasi Jenis Kurva Fungsi Keanggotaan

```
clear all;
clc
close all;

load Data_BMKG;

Variabel_Bebas=Data_BMKG(:,1:2);
Variabel_TakBebas=Data_BMKG(:,3);
Data_Training_VB=Variabel_Bebas(1:335,:);
Data_Testing_VB=Variabel_Bebas(336:372,:);
Data_Training_VTB=Variabel_TakBebas(1:335,:);
Data_Testing_VTB=Variabel_TakBebas(336:372,:);

%Membuat Spesifikasi FIS dengan Type Sugeno Output Tunggal
%Menghasilkan sebuah Struktur FIS tipe Sugeno yang digunakan sebagai
%kondisi awal untuk training ANFIS
DataTraining=[Data_Training_VB Data_Training_VTB]
numMFs1 = [5 5]
mfType1 = char('gaussmf','gaussmf');
numMFs2 = [5 5]
mfType2 = char('gbellmf','gbellmf');
numMFs3 = [5 5]
mfType3 = char('gauss2mf','gauss2mf');
numMFs4 = [5 5]
mfType4 = char('pimf','pimf');
numMFs5 = [5 5]
mfType5 = char('trapmf','trapmf');
%Jumlah MF sebanyak 5 tiap input
%Kurva yang digunakan Gaussian untuk kedua input
fismat1 = genfis1(DataTraining,numMFs1,mfType1);
fismat2 = genfis1(DataTraining,numMFs2,mfType2);
fismat3 = genfis1(DataTraining,numMFs3,mfType3);
fismat4 = genfis1(DataTraining,numMFs4,mfType4);
fismat5 = genfis1(DataTraining,numMFs5,mfType5);
%Menghasilkan sebuah FIS Sugeno output tunggal dan mencocokan parameter
%sistem menggunakan input/output training data yang spesifik.
%Struktur FIS otomatis dihasilkan menggunakan grid partitioning

MaxEpoch=100;
   ErrorGoal=0;
   InitialStepSize=0.01;
   StepSizeDecreaseRate=0.9;
   StepSizeIncreaseRate=1.1;

   MetodePembelajaran=1;
   %0=Backpropagation
   %1=Hybrid

   TrainOptions=[MaxEpoch ...
```

```
        ErrorGoal ...
        InitialStepSize ...
        StepSizeDecreaseRate ...
        StepSizeIncreaseRate];

    DisplayInfo=true;
    DisplayError=true;
    DisplayStepSize=true;
    DisplayFinalResult=true;

   DisplayOptions=[DisplayInfo ...
       DisplayError ...
       DisplayStepSize ...
       DisplayFinalResult];

fis1 = anfis(DataTraining, fismat1, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis2 = anfis(DataTraining, fismat2, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis3 = anfis(DataTraining, fismat3, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis4 = anfis(DataTraining, fismat4, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis5 = anfis(DataTraining, fismat5, TrainOptions,DisplayOptions,[], MetodePembelajaran);

%Iterasi yang dilakukan sebanyak 100
%fis merupakan model ANFIS setelah melakukan proses training
output1 = evalfis(Data_Testing_VB, fis1);
output2 = evalfis(Data_Testing_VB, fis2);
output3 = evalfis(Data_Testing_VB, fis3);
output4 = evalfis(Data_Testing_VB, fis4);
output5 = evalfis(Data_Testing_VB, fis5);

%PERHITUNGAN nilai RMSE dan MAE
Data_Aktual = Data_Testing_VTB
Data_Peramalan1 = output1
Data_Peramalan2 = output2
Data_Peramalan3 = output3
Data_Peramalan4 = output4
Data_Peramalan5 = output5
rmse1=sqrt(sum((Data_Aktual(:)-Data_Peramalan1(:)).^2)/numel(Data_Peramalan1));
rmse2=sqrt(sum((Data_Aktual(:)-Data_Peramalan2(:)).^2)/numel(Data_Peramalan2));
rmse3=sqrt(sum((Data_Aktual(:)-Data_Peramalan3(:)).^2)/numel(Data_Peramalan3));
rmse4=sqrt(sum((Data_Aktual(:)-Data_Peramalan4(:)).^2)/numel(Data_Peramalan4));
rmse5=sqrt(sum((Data_Aktual(:)-Data_Peramalan5(:)).^2)/numel(Data_Peramalan5));
error1=abs(Data_Peramalan1(:)-Data_Aktual(:));
error2=abs(Data_Peramalan2(:)-Data_Aktual(:));
error3=abs(Data_Peramalan3(:)-Data_Aktual(:));
error4=abs(Data_Peramalan4(:)-Data_Aktual(:));
error5=abs(Data_Peramalan5(:)-Data_Aktual(:));
mae1=sum(error1(:))/numel(error1);
mae2=sum(error2(:))/numel(error2);
mae3=sum(error3(:))/numel(error3);
mae4=sum(error4(:))/numel(error4);
```

```
mae5=sum(error5(:))/numel(error5);

%Plot hasil peramalan dan data aktual

sumbu_X = [1:100]';%Untuk urutan data di sumbu x

figure;
plot(Data_Peramalan1,'g-');
hold on
plot(Data_Aktual,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation Gaussmf');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan2,'g-');
hold on
plot(Data_Aktual,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation Gbellmf');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan3,'g-');
hold on
plot(Data_Aktual,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation Gauss2mf');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan4,'g-');
hold on
plot(Data_Aktual,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation Pimf');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan5,'g-');
hold on
plot(Data_Aktual,'r-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation Trapmf');
legend('ANFIS','Actual');
```

```
%Plot derajat keanggotaan dari masing masing input
figure;
[x,mf] = plotmf(fismat1, 'input',1);
subplot(2,1,1), plot(x,mf)
xlabel('input 1(gaussmf)')
[x,mf] = plotmf(fismat1, 'input',2);
subplot(2,1,2), plot(x,mf)
xlabel('input 2 (gaussmf)')

figure;
[x,mf] = plotmf(fismat2, 'input',1);
subplot(2,1,1), plot(x,mf)
xlabel('input 1(gbellmf)')
[x,mf] = plotmf(fismat2, 'input',2);
subplot(2,1,2), plot(x,mf)
xlabel('input 2 (gbellmf)')

figure;
[x,mf] = plotmf(fismat3, 'input',1);
subplot(2,1,1), plot(x,mf)
xlabel('input 1(gauss2mf)')
[x,mf] = plotmf(fismat3, 'input',2);
subplot(2,1,2), plot(x,mf)
xlabel('input 2 (gauss2mf)')

figure;
[x,mf] = plotmf(fismat4, 'input',1);
subplot(2,1,1), plot(x,mf)
xlabel('input 1(pimf)')
[x,mf] = plotmf(fismat4, 'input',2);
subplot(2,1,2), plot(x,mf)
xlabel('input 2 (pimf)')

figure;
[x,mf] = plotmf(fismat5, 'input',1);
subplot(2,1,1), plot(x,mf)
xlabel('input 1(trapmf)')
[x,mf] = plotmf(fismat5, 'input',2);
subplot(2,1,2), plot(x,mf)
xlabel('input 2 (trapmf)')
```

Program Peramalan ANFIS variasi jumlah membership function

```
clear all;
clc
close all;

load Data_BMKG;

Variabel_Bebas=Data_BMKG(:,1:2);
Variabel_TakBebas=Data_BMKG(:,3);
Data_Training_VB=Variabel_Bebas(1:335,:);
Data_Testing_VB=Variabel_Bebas(336:372,:);
Data_Training_VTB=Variabel_TakBebas(1:335,:);
Data_Testing_VTB=Variabel_TakBebas(336:372,:);

%Membuat Spesifikasi FIS dengan Type Sugeno Output Tunggal
%Menghasilkan sebuah Struktur FIS tipe Sugeno yang digunakan sebagai
%kondisi awal untuk training ANFIS
DataTraining=[Data_Training_VB Data_Training_VTB]
numMFs1 = [5 5]
mfType1 = char('gaussmf','gaussmf');
numMFs2 = [6 6]
mfType2 = char('gaussmf','gaussmf');
 numMFs3 = [7 7]
mfType3 = char('gaussmf','gaussmf');
numMFs4 = [8 8]
mfType4 = char('gaussmf','gaussmf');
numMFs5 = [9 9]
mfType5 = char('gaussmf','gaussmf');

%Jumlah MF sebanyak 5 tiap input
%Kurva yang digunakan Gaussian untuk kedua input
fismat1 = genfis1(DataTraining,numMFs1,mfType1);
fismat2 = genfis1(DataTraining,numMFs2,mfType2);
fismat3 = genfis1(DataTraining,numMFs3,mfType3);
fismat4 = genfis1(DataTraining,numMFs4,mfType4);
fismat5 = genfis1(DataTraining,numMFs5,mfType5);
%Menghasilkan sebuah FIS Sugeno output tunggal dan mencocokan parameter
%sistem menggunakan input/output training data yang spesifik.
%Struktur FIS otomatis dihasilkan menggunakan grid partitioning

 MaxEpoch=100;
   ErrorGoal=0;
   InitialStepSize=0.01;
   StepSizeDecreaseRate=0.9;
   StepSizeIncreaseRate=1.1;

   MetodePembelajaran=1;
   %0=Backpropagation
   %1=Hybrid
```

```
    TrainOptions=[MaxEpoch ...
        ErrorGoal ...
        InitialStepSize ...
        StepSizeDecreaseRate ...
        StepSizeIncreaseRate];

    DisplayInfo=true;
    DisplayError=true;
    DisplayStepSize=true;
    DisplayFinalResult=true;

    DisplayOptions=[DisplayInfo ...
        DisplayError ...
        DisplayStepSize ...
        DisplayFinalResult];

fis1 = anfis(DataTraining, fismat1, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis2 = anfis(DataTraining, fismat2, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis3 = anfis(DataTraining, fismat3, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis4 = anfis(DataTraining, fismat4, TrainOptions,DisplayOptions,[], MetodePembelajaran);
fis5 = anfis(DataTraining, fismat5, TrainOptions,DisplayOptions,[], MetodePembelajaran);
%Iterasi yang dilakukan sebanyak 100
%fis merupakan model ANFIS setelah melakukan proses training
output1 = evalfis(Data_Testing_VB, fis1);
output2 = evalfis(Data_Testing_VB, fis2);
output3 = evalfis(Data_Testing_VB, fis3);
output4 = evalfis(Data_Testing_VB, fis4);
output5 = evalfis(Data_Testing_VB, fis5);
%PERHITUNGAN nilai RMSE dan MAE
Data_Aktual = Data_Testing_VTB
Data_Peramalan1 = output1
Data_Peramalan2 = output2
Data_Peramalan3 = output3
Data_Peramalan4 = output4
Data_Peramalan5 = output5
rmse1=sqrt(sum((Data_Aktual(:)-Data_Peramalan1(:)).^2)/numel(Data_Peramalan1));
rmse2=sqrt(sum((Data_Aktual(:)-Data_Peramalan2(:)).^2)/numel(Data_Peramalan2));
rmse3=sqrt(sum((Data_Aktual(:)-Data_Peramalan3(:)).^2)/numel(Data_Peramalan3));
rmse4=sqrt(sum((Data_Aktual(:)-Data_Peramalan4(:)).^2)/numel(Data_Peramalan4));
rmse5=sqrt(sum((Data_Aktual(:)-Data_Peramalan5(:)).^2)/numel(Data_Peramalan5));
error1=abs(Data_Peramalan1(:)-Data_Aktual(:));
error2=abs(Data_Peramalan2(:)-Data_Aktual(:));
error3=abs(Data_Peramalan3(:)-Data_Aktual(:));
error4=abs(Data_Peramalan4(:)-Data_Aktual(:));
error5=abs(Data_Peramalan5(:)-Data_Aktual(:));
mae1=sum(error1(:))/numel(error1);
mae2=sum(error2(:))/numel(error2);
mae3=sum(error3(:))/numel(error3);
mae4=sum(error4(:))/numel(error4);
mae5=sum(error5(:))/numel(error5);
```

```
%Plot Output Forecasting dan data aktual
sumbu_X = [1:100]';%Untuk urutan data di sumbu x

figure;
plot(Data_Peramalan1,'m-');
hold on
plot(Data_Aktual,'b-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation MF 5');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan2,'m-');
hold on
plot(Data_Aktual,'b-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation MF 6');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan3,'m-');
hold on
plot(Data_Aktual,'b-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation MF 7');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan4,'m-');
hold on
plot(Data_Aktual,'b-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation MF 8');
legend('ANFIS','Actual');

figure;
plot(Data_Peramalan5,'m-');
hold on
plot(Data_Aktual,'b-');
xlabel('Data');
ylabel('Solar Radiation(W/m2)');
title('Output Forecasting Solar Radiation MF 9');
legend('ANFIS','Actual');
```

Program Peramalan Regresi Linier Berganda 2 Prediktor

```
clear all
clc
close all

load DataRegresi;
%Pembagian Data Training dan Data Testing 90%-10%
data_training = DataRegresi(1:353,:);
data_tes = DataRegresi(354:372,:);
%Pembagian Data Testing untuk Temperature dan Lama Penyinaran Matahari
T_tes = data_tes(:,4);
LPM_tes = data_tes(:,3);

%Pembagian Data Training
n = data_training(:,1);
y = data_training(:,2); %Data Intensitas Radiasi Matahari
x1 = data_training(:,3);%Data Lama Penyinaran Matahari
x2 = data_training(:,4);%Data Temperature
JMLn = length(n); %Jumlah data
JMLx1 = sum(x1); %Jumlah Lama Penyinaran Matahari Data Training
JMLx2 = sum(x2); %Jumlah Temperature Data Training
x1x2 = x1.*x2; %Perkalian LPM dan T
JMLx1x2 = sum(x1x2); %Jumlah Perkalian LPM dan T
x1sqre=x1.^2; %Mengkuadratkan nilai LPM
x2sqre=x2.^2; %Mengkuadratkan nilai T
JMLx1sqre = sum(x1sqre); %Jumlah LPM kuadrat
JMLx2sqre = sum(x2sqre); %Jumlah T kuadrat
JMLy = sum(y); %Jumlah Intensitas Radiasi Matahari Data Training
x1y = x1.*y; %Perkalian Data LPM dan IRM
x2y = x2.*y; %Perkalian Data T dan IRM
JMLx1y = sum(x1y); %Jumlah perkalian data LPM dan IRM
JMLx2y = sum(x2y); %Jumlah perkalian data T dan IRM

%Membuat Matrix dari hasil perhitungan di atas
A=[JMLn JMLx1 JMLx2; JMLx1 JMLx1sqre JMLx1x2; JMLx2 JMLx1x2 JMLx2sqre];
G = [JMLy; JMLx1y; JMLx2y;]
Ai = inv(A);
% A * B = G;
% B = [b0; b1; b2;]
B = Ai * G
Bt = B';
%Nilai koefisien Regresi Linier Berganda
b0 = Bt(1,1);
b1 = Bt(1,2);
b2 = Bt(1,3);

disp('Persamaan Regresi Linier Berganda');
disp('Y = b0 + b1*X1 + b2*X2');

b0, b1 ,b2
```

```
%Melakukan peramalan dimana kita memasukan data testing ke dalam
%persamaan Regresi Linier Berganda yang telah ditemukan dari perhitungan
%sebelumnya
Output = b0 + (b1*LPM_tes) + (b2*T_tes);

%Perhitungan error peramalan Regresi Linier Berganda
Data_Aktual = data_tes(:,2);
rmse1=sqrt(sum((Data_Aktual(:)-Output(:)).^2)/numel(Data_Aktual));
error1=abs(Output(:) - Data_Aktual(:));
MAE1=sum(error1(:))/numel(error1);
%Plot Regresi Linier Berganda
Sumbu_X = [1:72]'; %untuk urutan data pada sumbu x

plot(Output, 'g-');
hold on
plot(Data_Aktual, 'r-');
xlabel('Data');
ylabel('Solar Radiation (W/m2)');
title('Output Forecasting Solar Radiation Multiple Regresion');
legend('MultipleRegresion','Actual');
```

Program Peramalan Regresi Linier Berganda 4 Prediktor

```
clear all
clc
close all

load DataN1;

%Pembagian Data Training dan Data Testing 90%-10%
data_training = DataN1(1:41610,:);
data_tes = DataN1(41611:43800,:);

%Pembagian Data Testing untuk Temperature dan Lama Penyinaran Matahari
T_tes = data_tes(:,1); %Temperature
CH_tes = data_tes(:,2); %Kelembaban
LPM_tes = data_tes(:,3); %Curah Hujan
WS_tes = data_tes(:,4); %LPM

%Pembagian Data Training
n = data_training(:,1);
y = data_training(:,6); %Data Intensitas Radiasi Matahari
x1 = data_training(:,1);%Data Temperature
x2 = data_training(:,2);%Data Kelembaban
x3 = data_training(:,3);%Data Curah Hujan
x4 = data_training(:,4);%Data LPM
JMLn = length(n); %Jumlah data
JMLx1 = sum(x1); %Jumlah Temperature Data Training
JMLx2 = sum(x2); %Jumlah Kelembaban Data Training
JMLx3 = sum(x3); %Jumlah Curah Hujan Data Training
JMLx4 = sum(x4); %Jumlah LPM
x1x2 = x1.*x2; %Perkalian T dan H
x1x3 = x1.*x3; %Perkalian T dan CH
x1x4 = x1.*x4; %Perkalian T dan LPM
x2x3 = x2.*x3; %Perkalian H dan CH
x2x4 = x2.*x4; %Perkalian H dan LPM
x3x4 = x3.*x4; %Perkalian CH dan LPM
JMLx1x2 = sum(x1x2); %Jumlah Perkalian T dan H
JMLx1x3 = sum(x1x3); %Jumlah Perkalian T dan CH
JMLx1x4 = sum(x1x4); %Jumlah Perkalian T dan LPM
JMLx2x3 = sum(x2x3); %Jumlah Perkalian H dan CH
JMLx2x4 = sum(x2x4); %Jumlah Perkalian H dan LPM
JMLx3x4 = sum(x3x4); %Jumlah Perkalian CH dan LPM
x1sqre=x1.^2; %Mengkuadratkan nilai T
x2sqre=x2.^2; %Mengkuadratkan nilai H
x3sqre=x3.^2; %Mengkuadratkan nilai CH
x4sqre=x4.^2; %Mengkuadratkan nilai LPM
JMLx1sqre = sum(x1sqre); %Jumlah T kuadrat
JMLx2sqre = sum(x2sqre); %Jumlah H kuadrat
JMLx3sqre = sum(x3sqre); %Jumlah CH kuadrat
JMLx4sqre = sum(x4sqre); %Jumlah LPM kuadrat
JMLy = sum(y); %Jumlah Intensitas Radiasi Matahari Data Training
```

```
x1y = x1.*y; %Perkalian Data T dan IRM
x2y = x2.*y; %Perkalian Data H dan IRM
x3y = x3.*y; %Perkalian Data CH dan IRM
x4y = x4.*y; %Perkalian Data LPM dan IRM
JMLx1y = sum(x1y); %Jumlah perkalian data T dan IRM
JMLx2y = sum(x2y); %Jumlah perkalian data H dan IRM
JMLx3y = sum(x3y); %Jumlah perkalian data CH dan IRM
JMLx4y = sum(x4y); %Jumlah perkalian data LPM dan IRM

%Membuat Matrix dari hasil perhitungan di atas
%A=[JMLn JMLx1 JMLx2; JMLx1 JMLx1sqre JMLx1x2; JMLx2 JMLx1x2 JMLx2sqre];
%G = [JMLy; JMLx1y; JMLx2y;]
A=[JMLx1sqre JMLx1x2 JMLx1x3 JMLx1x4; JMLx1x2 JMLx2sqre JMLx2x3 JMLx2x4;
JMLx1x3 JMLx2x3 JMLx3sqre JMLx3x4; JMLx1x4 JMLx2x4 JMLx3x4 JMLx4sqre];
G = [JMLx1y; JMLx2y; JMLx3y; JMLx4y;]

Ai = inv(A);

% A * B = G;
% B = [b1; b2; b3; b4;]

B = Ai * G
Bt = B';
%Nilai koefisien Regresi Linier Berganda

b1 = Bt(1,1);
b2 = Bt(1,2);
b3 = Bt(1,3);
b4 = Bt(1,4);

b0 = mean(y) - b1*mean(x1) - b2*mean(x2) - b3*mean(x3) - b4*mean(x4);

disp('Persamaan Regresi Linier Berganda');
disp('Y = b0 + b1*X1 + b2*X2 +b3*X3 + b4*X4');

b0, b1 ,b2, b3, b4
%Melakukan peramalan dimana kita memasukan data testing ke dalam
%persamaan Regresi Linier Berganda yang telah ditemukan dari perhitungan
%sebelumnya
Output = b0 + (b1*T_tes) + (b2*CH_tes) +(b3*LPM_tes) + (b4*WS_tes);

%Output2 = -6.18212 + (490.6752*LPM_tes) + (7.940368*T_tes);
%Perhitungan error peramalan Regresi Linier Berganda
Data_Aktual = data_tes(:,6);
rmse1=sqrt(sum((Data_Aktual(:)-Output(:)).^2)/numel(Data_Aktual));
error1=abs(Output(:) - Data_Aktual(:));
MAE1=sum(error1(:))/numel(error1);
%Plot Regresi Linier Berganda
Sumbu_X = [1:72]'; %untuk urutan data pada sumbu x
```

```
plot(Output, 'g-');
hold on
plot(Data_Aktual, 'r-');
xlabel('Data ke-');
ylabel('Solar Radiation (W/m2)');
title('Output Forecasting Solar Radiation');
legend('Multiple Linier Regression','Actual');
```

Program Perbandingan Peramalan ANFIS dan Regresi Linier Berganda

```
clear all;
clc
close all;

load Data_BMKG;

Variabel_Bebas=Data_BMKG(:,1:2);
Variabel_TakBebas=Data_BMKG(:,3);
Data_Training_VB=Variabel_Bebas(1:353,:);
Data_Testing_VB=Variabel_Bebas(354:372,:);
Data_Training_VTB=Variabel_TakBebas(1:353,:);
Data_Testing_VTB=Variabel_TakBebas(354:372,:);

%Membuat Spesifikasi FIS dengan Type Sugeno Output Tunggal
%Menghasilkan sebuah Struktur FIS tipe Sugeno yang digunakan sebagai
%kondisi awal untuk training ANFIS
DataTraining=[Data_Training_VB Data_Training_VTB]
numMFs = [5 5]
mfType = char('gauss2mf','gauss2mf');
xin=Data_BMKG(:,1:2);
xout=Data_BMKG(:,3);
%Jumlah MF sebanyak 5 tiap input
%Kurva yang digunakan Gaussian untuk kedua input
%fismat = genfis1(DataTraining,numMFs,mfType);
fismat = genfis2(xin,xout,0.5);
%Menghasilkan sebuah FIS Sugeno output tunggal dan mencocokan parameter
%sistem menggunakan input/output training data yang spesifik.
%Struktur FIS otomatis dihasilkan menggunakan grid partitioning
%% Pembelajaran ANFIS

MaxEpoch=100;
   ErrorGoal=0;
   InitialStepSize=0.01;
   StepSizeDecreaseRate=0.9;
   StepSizeIncreaseRate=1.1;

   MetodePembelajaran=1;
   %0=Backpropagation
   %1=Hybrid

   TrainOptions=[MaxEpoch ...
      ErrorGoal ...
      InitialStepSize ...
      StepSizeDecreaseRate ...
      StepSizeIncreaseRate];

   DisplayInfo=true;
   DisplayError=true;
   DisplayStepSize=true;
```

```
    DisplayFinalResult=true;

   DisplayOptions=[DisplayInfo ...
       DisplayError ...
       DisplayStepSize ...
       DisplayFinalResult];

%FuzzyInference=anfis([TrainInput TrainOutput],fis,TrainOptions,DisplayOptions,[],
MetodePembelajaran);
fis = anfis(DataTraining, fismat, TrainOptions,DisplayOptions,[], MetodePembelajaran);
%Iterasi yang dilakukan sebanyak 100
%fis merupakan model ANFIS setelah melakukan proses training
outputANFIS = evalfis(Data_Testing_VB, fis);

%%%%%%PROGRAM REGRESI LINIER BERGANDA
load DataRegresi;
%Pembagian Data Training dan Data Testing 90%-10%
data_training = DataRegresi(1:353,:);
data_tes = DataRegresi(354:372,:);
%Pembagian Data Testing untuk Temperature dan Lama Penyinaran Matahari
T_tes = data_tes(:,4);
LPM_tes = data_tes(:,3);
Data_Aktual = data_tes(:,2);

%Pembagian Data Training
n = data_training(:,1);
y = data_training(:,2); %Data Intensitas Radiasi Matahari
x1 = data_training(:,3);%Data Lama Penyinaran Matahari
x2 = data_training(:,4);%Data Temperature
JMLn = length(n); %Jumlah data
JMLx1 = sum(x1); %Jumlah Lama Penyinaran Matahari Data Training
JMLx2 = sum(x2); %Jumlah Temperature Data Training
x1x2 = x1.*x2; %Perkalian LPM dan T
JMLx1x2 = sum(x1x2); %Jumlah Perkalian LPM dan T
x1sqre=x1.^2; %Mengkuadratkan nilai LPM
x2sqre=x2.^2; %Mengkuadratkan nilai T
JMLx1sqre = sum(x1sqre); %Jumlah LPM kuadrat
JMLx2sqre = sum(x2sqre); %Jumlah T kuadrat
JMLy = sum(y); %Jumlah Intensitas Radiasi Matahari Data Training
x1y = x1.*y; %Perkalian Data LPM dan IRM
x2y = x2.*y; %Perkalian Data T dan IRM
JMLx1y = sum(x1y); %Jumlah perkalian data LPM dan IRM
JMLx2y = sum(x2y); %Jumlah perkalian data T dan IRM

%Membuat Matrix dari hasil perhitungan di atas
A=[JMLn JMLx1 JMLx2; JMLx1 JMLx1sqre JMLx1x2; JMLx2 JMLx1x2 JMLx2sqre];
G = [JMLy; JMLx1y; JMLx2y;]
Ai = inv(A);
B = Ai * G
Bt = B';
```

```
%Nilai koefisien Regresi Linier Berganda
b0 = Bt(1,1);
b1 = Bt(1,2);
b2 = Bt(1,3);
disp('Persamaan Regresi Linier Berganda');
disp('Y = b0 + b1*X1 + b2*X2');
b0, b1 ,b2

%Melakukan peramalan dimana kita memasukan data testing ke dalam
%persamaan Regresi Linier Berganda yang telah ditemukan dari perhitungan
%sebelumnya
Output = b0 + (b1*LPM_tes) + (b2*T_tes);

%%%PLOT GRAFIK
Sumbu_X = [1:72]'; %untuk urutan data pada sumbu x
plot(Output, '-bo');
hold on
plot(outputANFIS, '-g*');
hold on
plot(Data_Aktual, '-ro');
xlabel('Data');
ylabel('Solar Radiation (W/m2)');
title('Output Forecasting Solar Radiation');
legend('Multiple Regresion','ANFIS','Actual');

%Perhitungan Error ANFIS
rmse1=sqrt(sum((Data_Aktual(:)-outputANFIS(:)).^2)/numel(Data_Aktual));
error1=abs(outputANFIS(:) - Data_Aktual(:));
MAE1=sum(error1(:))/numel(error1);
%Perhitungan Error Regresi Linier Berganda
rmse2=sqrt(sum((Data_Aktual(:)-Output(:)).^2)/numel(Data_Aktual));
error2=abs(Output(:) - Data_Aktual(:));
MAE2=sum(error2(:))/numel(error2);
```

Program Perbandingan Peramalan ANFIS dan Regresi Linier Berganda Data Bassel

```
clear all
clc
close all
%Memanggil Data
load DataN1;

%DataN1 = DataN1;

x1=DataN1(:,1); %Data Temperature
x2=DataN1(:,2); %Data Kelembaban
x3=DataN1(:,3); %Data Curah Hujan
x4=DataN1(:,4); %Data Lama Penyinaran Matahari
x5=DataN1(:,5); %Data Kecepatan Angin

y1 =DataN1(:,6); %Data Intensitas Radiasi Matahari


Input_ANFIS = [x1 x2 x3 x4]; %Perlu diganti
Output_ANFIS = y1;

Xin = Input_ANFIS;
Xout = y1;
Data_ANFIS = [Input_ANFIS Output_ANFIS];
Trn_ANFIS = Data_ANFIS(1:8760,:);
Tes_ANFIS = Data_ANFIS(8761:8784,:);
Input_tes_ANFIS = Tes_ANFIS(:,1:4); %Perlu diganti
%% Membangkitkan Fuzzy Inference System

DataTraining1=[Data_Training_VB1 Data_Training_VTB1]
numMFs1 = [5 5]
mfType1 = char('gaussmf','gaussmf');

%In_fisANFIS = genfis1(Trn_ANFIS, 3, 'gaussmf', 'linier');

In_fisANFIS = genfis2(Xin,Xout,1);

%% Pembelajaran ANFIS

 MaxEpoch=100;
    ErrorGoal=0;
    InitialStepSize=0.01;
    StepSizeDecreaseRate=0.9;
    StepSizeIncreaseRate=1.1;

    MetodePembelajaran=1;
    %0=Backpropagation
    %1=Hybrid

    TrainOptions=[MaxEpoch ...
```

```
        ErrorGoal ...
        InitialStepSize ...
        StepSizeDecreaseRate ...
        StepSizeIncreaseRate];

    DisplayInfo=true;
    DisplayError=true;
    DisplayStepSize=true;
    DisplayFinalResult=true;

   DisplayOptions=[DisplayInfo ...
       DisplayError ...
       DisplayStepSize ...
       DisplayFinalResult];


Out_fisANFIS = anfis(Trn_ANFIS, In_fisANFIS, TrainOptions,DisplayOptions,[],
MetodePembelajaran);
Hasil_ANFIS_real = evalfis(Input_tes_ANFIS, Out_fisANFIS);
Output = Hasil_ANFIS_real;

%Perhitungan Error RMSE
Real_Tes = DataN1(8761:8784,:);
Data_AktualANFIS = Real_Tes(:,6);
Data_PerkiraanANFIS = Output;

rmseANFIS=sqrt(sum((Data_AktualANFIS(:)-
Data_PerkiraanANFIS(:)).^2)/numel(Data_AktualANFIS));

%TRIAL MAE
Data_AktualANFIS = Real_Tes(:,6); %Perlu diganti

errorANFIS = abs(Data_PerkiraanANFIS(:) - Data_AktualANFIS(:));

MAEANFIS = sum(errorANFIS(:))/numel(errorANFIS);

Sumbu_x = [1:62]'; % untuk urutan data pada sumbu x

data_training = DataN1(1:8760,:);
data_tes = DataN1(8761:8784,:);

%Pembagian Data Testing untuk Temperature dan Lama Penyinaran Matahari
T_tes = data_tes(:,1); %Temperature
CH_tes = data_tes(:,2); %Kelembaban
LPM_tes = data_tes(:,3); %Curah Hujan
WS_tes = data_tes(:,4); %LPM

%Pembagian Data Training
n = data_training(:,1);
y = data_training(:,6); %Data Intensitas Radiasi Matahari
```

```
x1 = data_training(:,1);%Data Temperature
x2 = data_training(:,2);%Data Kelembaban
x3 = data_training(:,3);%Data Curah Hujan
x4 = data_training(:,4);%Data LPM

JMLn = length(n); %Jumlah data
JMLx1 = sum(x1); %Jumlah Temperature Data Training
JMLx2 = sum(x2); %Jumlah Kelembaban Data Training
JMLx3 = sum(x3); %Jumlah Curah Hujan Data Training
JMLx4 = sum(x4); %Jumlah LPM

x1x2 = x1.*x2; %Perkalian T dan H
x1x3 = x1.*x3; %Perkalian T dan CH
x1x4 = x1.*x4; %Perkalian T dan LPM
x2x3 = x2.*x3; %Perkalian H dan CH
x2x4 = x2.*x4; %Perkalian H dan LPM
x3x4 = x3.*x4; %Perkalian CH dan LPM

JMLx1x2 = sum(x1x2); %Jumlah Perkalian T dan H
JMLx1x3 = sum(x1x3); %Jumlah Perkalian T dan CH
JMLx1x4 = sum(x1x4); %Jumlah Perkalian T dan LPM
JMLx2x3 = sum(x2x3); %Jumlah Perkalian H dan CH
JMLx2x4 = sum(x2x4); %Jumlah Perkalian H dan LPM
JMLx3x4 = sum(x3x4); %Jumlah Perkalian CH dan LPM
x1sqre=x1.^2; %Mengkuadratkan nilai T
x2sqre=x2.^2; %Mengkuadratkan nilai H
x3sqre=x3.^2; %Mengkuadratkan nilai CH
x4sqre=x4.^2; %Mengkuadratkan nilai LPM

JMLx1sqre = sum(x1sqre); %Jumlah T kuadrat
JMLx2sqre = sum(x2sqre); %Jumlah H kuadrat
JMLx3sqre = sum(x3sqre); %Jumlah CH kuadrat
JMLx4sqre = sum(x4sqre); %Jumlah LPM kuadrat

JMLy = sum(y); %Jumlah Intensitas Radiasi Matahari Data Training

x1y = x1.*y; %Perkalian Data T dan IRM
x2y = x2.*y; %Perkalian Data H dan IRM
x3y = x3.*y; %Perkalian Data CH dan IRM
x4y = x4.*y; %Perkalian Data LPM dan IRM

JMLx1y = sum(x1y); %Jumlah perkalian data T dan IRM
JMLx2y = sum(x2y); %Jumlah perkalian data H dan IRM
JMLx3y = sum(x3y); %Jumlah perkalian data CH dan IRM
JMLx4y = sum(x4y); %Jumlah perkalian data LPM dan IRM

%Membuat Matrix dari hasil perhitungan di atas
%A=[JMLn JMLx1 JMLx2; JMLx1 JMLx1sqre JMLx1x2; JMLx2 JMLx1x2 JMLx2sqre];
%G = [JMLy; JMLx1y; JMLx2y;]
```

```
A=[JMLx1sqre JMLx1x2 JMLx1x3 JMLx1x4; JMLx1x2 JMLx2sqre JMLx2x3 JMLx2x4;
JMLx1x3 JMLx2x3 JMLx3sqre JMLx3x4; JMLx1x4 JMLx2x4 JMLx3x4 JMLx4sqre];
G = [JMLx1y; JMLx2y; JMLx3y; JMLx4y;]

Ai = inv(A);

% A * B = G;
% B = [b1; b2; b3; b4;]

B = Ai * G
Bt = B';
%Nilai koefisien Regresi Linier Berganda

b1 = Bt(1,1);
b2 = Bt(1,2);
b3 = Bt(1,3);
b4 = Bt(1,4);

b0 = mean(y) - b1*mean(x1) - b2*mean(x2) - b3*mean(x3) - b4*mean(x4);

disp('Persamaan Regresi Linier Berganda');
disp('Y = b0 + b1*X1 + b2*X2 +b3*X3 + b4*X4');

b0, b1 ,b2, b3, b4


%Melakukan peramalan dimana kita memasukan data testing ke dalam
%persamaan Regresi Linier Berganda yang telah ditemukan dari perhitungan
%sebelumnya
Output2 = b0 + (b1*T_tes) + (b2*CH_tes) +(b3*LPM_tes) + (b4*WS_tes);

%Output2 = -6.18212 + (490.6752*LPM_tes) + (7.940368*T_tes);
%Perhitungan error peramalan Regresi Linier Berganda
%Data_Aktual = data(:,6);
Data_Aktual = data_tes(:,6);
rmse1=sqrt(sum((Data_Aktual(:)-Output2(:)).^2)/numel(Data_Aktual));
error1=abs(Output2(:) - Data_Aktual(:));
MAE1=sum(error1(:))/numel(error1);
%Plot Regresi Linier Berganda
Sumbu_X = [1:72]'; %untuk urutan data pada sumbu x

plot(Output, 'g-');
hold on
plot(Output2, 'b-');
hold on
plot(Data_Aktual, 'r-');
xlabel('Hour');
ylabel('Solar Radiation (W/m2)');
title('Output Forecasting Solar Radiation');
legend('ANFIS','Multiple Regresion','Actual');
```

Lampiran 3 Hasil Peramalan Intensitas Radiasi Matahari

Percobaan Variasi Data Training dan Testing Kota Malang Metode ANFIS

Intensitas Radiasi Matahari (W / m^2)						
70% -30%	**75% -25%**	**80% -20%**	**85% -15%**	**90% -10%**	**95% - 5%**	**aktual**
570,829	597,180	577,750	627,744	630,402	631,917	701,700
569,574	562,949	584,686	582,095	564,110	564,449	861,800
522,776	488,975	529,992	543,662	540,302	536,215	619,600
522,776	488,975	529,992	543,662	540,302	536,215	433,300
455,352	429,191	453,086	476,054	462,756	469,065	348,700
268,497	256,396	255,793	277,357	268,334	272,304	230,900
123,194	130,710	125,454	119,130	117,477	118,449	126,400
87,211	76,990	75,637	77,481	77,435	69,494	50,500
102,065	109,714	104,874	95,238	93,698	96,374	255,300
123,194	130,710	125,454	119,130	117,477	118,449	298,100
207,032	202,419	198,878	210,675	205,710	205,556	298,100
268,497	256,396	255,793	277,357	268,334	272,304	443,100
268,497	256,396	255,793	277,357	268,334	272,304	360,700
226,358	219,118	216,335	231,645	225,473	226,404	351,200
123,194	130,710	125,454	119,130	117,477	118,449	325,500
102,065	109,714	104,874	95,238	93,698	96,374	226,800
114,777	122,865	117,671	109,716	108,141	109,856	142,600
107,775	115,905	110,851	101,792	100,244	102,559	156,100
102,065	109,714	104,874	95,238	93,698	96,374	81,900

Percobaan Variasi Jumlah MF Metode ANFIS

Intensitas Radiasi Matahari (W / m^2)					
MF = 5	**MF = 6**	**MF = 7**	**MF = 8**	**MF = 9**	**aktual**
78,00437	79,97487	79,91099	95,67116	92,37893	5,2
130,4424	179,5392	160,8055	191,0018	186,8356	69,7
331,7127	-869,565	-25,043	-36129,2	-356107	219
137,5851	125,4331	135,438	120,9228	123,8547	167,2
210,8729	236,799	204,3988	225,4372	221,9118	232,7
404,3784	406,6079	516,5719	498,1606	517,6217	438,7
238,278	191,7394	-532,182	341,3802	-1486,62	607
412,4998	373,1236	407,8782	597,8457	407,3934	314,6
93,52377	102,4852	96,49934	110,214	105,1472	126,9
86,21819	75,38651	82,71788	80,2703	82,07935	104,9
83,47832	73,68987	81,27079	91,48125	90,32655	59,4
72,79508	87,00363	77,92583	69,70499	70,18879	9,1
71,48021	86,78556	76,60493	57,45738	59,87448	3,3
69,36003	73,82627	69,54449	37,29533	42,48588	70,6
87,18695	78,0994	83,61868	75,33297	78,33952	224,2
266,6809	271,4122	266,3868	277,6089	221,9216	480,7
285,408	297,8872	199,8242	161,9786	204,5701	528,4
576,6236	566,6961	603,1933	591,1108	622,9993	701,7
655,8285	618,0884	637,8945	617,7629	551,6739	861,8
754,5658	309,7971	625,6334	789,8756	798,5429	619,6
366,9819	406,769	690,1675	607,2101	-277,712	433,3
366,9819	406,769	690,1675	607,2101	-277,712	348,7
408,8416	410,1805	372,3557	402,8246	419,9411	230,9
259,2589	247,762	289,3207	288,3771	277,2422	126,4
108,1434	98,76492	111,6244	116,1598	126,7775	27,6
72,79508	87,00363	77,92583	69,70499	70,18879	50,5
90,60786	102,8225	92,19264	98,64162	92,6958	255,3
108,1434	98,76492	111,6244	116,1598	126,7775	298,1
210,8729	236,799	204,3988	225,4372	221,9118	443,1
259,2589	247,762	289,3207	288,3771	277,2422	360,7
259,2589	247,762	289,3207	288,3771	277,2422	351,2
225,7599	247,9924	263,48	249,3741	289,4762	325,5
108,1434	98,76492	111,6244	116,1598	126,7775	226,8
90,60786	102,8225	92,19264	98,64162	92,6958	142,6
99,09305	99,35424	102,8477	115,7252	117,2366	156,1
93,52377	102,4852	96,49934	110,214	105,1472	81,9
90,60786	102,8225	92,19264	98,64162	92,6958	19,4

Percobaan Variasi Jenis Kurva *Membership Function* Metode ANFIS

Intensitas Radiasi Matahari (W / m^2)					
gaussmf	**gbellmf**	**gauss2mf**	**trapmf**	**pimf**	**aktual**
78,00437	82,88468	86,85727	92,96398	89,69231	5,2
130,4424	134,6882	162,0143	142,305	140,1876	69,7
331,7127	412,4355	212,0947	203,3326	210,6617	219
137,5851	131,7374	125,6946	125,0196	124,4141	167,2
210,8729	204,0747	210,3573	200,7896	204,4056	232,7
404,3784	386,8189	379,7325	396,6919	396,2471	438,7
238,278	262,9431	238,7003	344,6408	382,287	607
412,4998	398,9948	413,5294	372,3348	386,5431	314,6
93,52377	99,6879	102,0421	105,5622	104,491	126,9
86,21819	81,47854	79,40941	68,06978	75,92337	104,9
83,47832	81,83367	81,38285	84,80056	79,99424	59,4
72,79508	78,81521	80,26966	85,62808	81,15005	9,1
71,48021	76,11715	75,70506	80,49069	74,95489	3,3
69,36003	65,61146	59,58451	51,77643	55,60055	70,6
87,18695	81,95834	79,98698	71,78004	76,64935	224,2
266,6809	266,8775	272,1431	290,5093	287,3244	480,7
285,408	282,424	287,3632	278,8854	273,954	528,4
576,6236	561,4979	596,5009	587,1464	568,2243	701,7
655,8285	657,1247	631,3154	571,3355	594,5855	861,8
754,5658	746,489	754,8801	720,9853	730,0013	619,6
366,9819	451,0497	370,5563	548,1537	640,0803	433,3
366,9819	451,0497	370,5563	548,1537	640,0803	348,7
408,8416	405,1933	409,6872	378,303	389,6645	230,9
259,2589	274,7286	278,4827	284,7477	286,777	126,4
108,1434	111,986	113,2534	120,5766	116,9999	27,6
72,79508	78,81521	80,26966	85,62808	81,15005	50,5
90,60786	94,5823	96,30176	98,05509	98,23656	255,3
108,1434	111,986	113,2534	120,5766	116,9999	298,1
210,8729	204,0747	210,3573	200,7896	204,4056	443,1
259,2589	274,7286	278,4827	284,7477	286,777	360,7
259,2589	274,7286	278,4827	284,7477	286,777	351,2
225,7599	226,2601	234,1479	228,7756	232,042	325,5
108,1434	111,986	113,2534	120,5766	116,9999	226,8
90,60786	94,5823	96,30176	98,05509	98,23656	142,6
99,09305	105,3475	107,7288	113,0694	110,7455	156,1
93,52377	99,6879	102,0421	105,5622	104,491	81,9
90,60786	94,5823	96,30176	98,05509	98,23656	19,4

Percobaan Regresi Kota Malang

Intensitas Radiasi Matahari (W / m^2)						
70% 30%	**75% 25%**	**80% 20%**	**85% 15%**	**90% 10%**	**95% - 5%**	**aktual**
644,065	644,745	648,986	652,543	642,310	643,349	701,700
527,661	527,845	532,097	541,397	529,735	532,307	861,800
439,357	438,871	443,640	459,943	445,731	449,958	619,600
439,357	438,871	443,640	459,943	445,731	449,958	433,300
397,207	396,980	400,990	415,404	402,875	406,919	348,700
284,808	285,272	287,258	296,635	288,593	292,148	230,900
158,359	159,599	159,310	163,020	160,026	163,030	126,400
3,810	6,000	2,928	-0,288	2,888	5,219	50,500
116,209	117,709	116,660	118,481	117,170	119,991	255,300
158,359	159,599	159,310	163,020	160,026	163,030	298,100
242,658	243,381	244,609	252,097	245,737	249,108	298,100
284,808	285,272	287,258	296,635	288,593	292,148	443,100
284,808	285,272	287,258	296,635	288,593	292,148	360,700
256,708	257,344	258,825	266,943	260,023	263,455	351,200
158,359	159,599	159,310	163,020	160,026	163,030	325,500
116,209	117,709	116,660	118,481	117,170	119,991	226,800
144,309	145,636	145,093	148,173	145,741	148,683	142,600
130,259	131,672	130,877	133,327	131,455	134,337	156,100
116,209	117,709	116,660	118,481	117,170	119,991	81,900

Peramalan Metode ANFIS Kota Bassel

Intensitas Radiasi Matahari (W / m^2)					
70% - 30%	**75% - 25%**	**80% - 20%**	**85% - 15%**	**90% - 10%**	**95% - 5%**
710,1456	218,8729	-18,2836	-2,69641	118,9773	254,0005
744,671	139,9783	-41,9063	108,6667	236,9701	179,1195
762,9708	124,12	-41,701	229,3158	239,3971	131,614
784,4711	117,8578	-39,2716	104,7253	374,4826	115,7723
785,6719	115,7449	-37,0817	133,4384	418,0098	165,4782
773,376	88,36541	-13,2196	371,8267	411,7767	189,5611
746,7102	27,90252	65,22603	523,4524	411,3654	181,0351
704,8011	19,15905	70,98233	511,1851	411,2531	160,6828
356,0666	25,8267	59,32499	538,927	270,9419	176,3346
167,8327	15,60051	71,42715	201,119	116,6522	181,4653
139,1929	7,561337	47,42025	259,104	106,481	166,0685
115,7032	-0,36663	40,0058	500,8925	96,02987	164,4584
102,1061	-8,70234	59,81462	488,2053	97,12505	179,5852
137,965	122,912	72,96064	367,2987	79,12799	348,4545
138,667	182,1401	51,95535	118,1462	72,28217	498,6727
127,3287	278,5698	44,06973	63,32321	77,12272	544,8073
132,8473	371,086	28,02476	139,9974	74,06735	578,0835
232,6499	407,7598	31,07793	138,3208	65,8914	615,0756
438,5615	469,3528	25,3732	132,0512	59,04558	653,236
436,6011	470,0821	5,522284	105,0753	74,3723	650,3175
499,2509	501,2978	10,42253	59,68563	194,3007	641,2908
559,6083	521,7808	19,29145	-6,08398	258,4664	609,6093
621,8563	538,7707	23,96131	-17,8939	284,3597	587,5966
683,8117	534,151	8,215934	-19,6732	408,8986	562,0953
723,5027	210,8556	0,604051	-17,7834	441,1807	189,8608
770,1057	137,7959	1,94638	-11,3691	532,3679	159,5123
787,9688	96,4486	-15,2277	-7,76848	542,6625	150,7063
797,2825	67,218	-26,6456	-3,6888	544,4567	147,2658
793,6452	57,10301	-30,6226	-6,6051	551,674	133,0942
782,1135	42,83869	-28,1511	23,116	550,9762	99,16533
778,6203	37,68853	-20,8472	41,59037	542,8745	89,02919
754,2818	33,39093	-3,42566	69,75325	538,5757	95,38496
369,2614	29,46402	-3,52831	83,77156	336,2154	91,4195
186,9483	24,31385	-2,91241	310,0194	170,6783	90,01936
153,4549	15,45918	167,585	338,0657	121,7627	88,65423
160,4932	1,787962	231,2261	323,4259	95,86969	100,5506
167,052	-11,9574	247,5118	294,4489	98,61004	108,4815
158,9016	131,1891	230,2258	231,3146	109,4913	109,0766
189,981	268,025	136,1358	23,67135	126,5394	131,3191
195,2771	319,322	51,45784	15,47778	122,3714	161,8427
186,1259	360,288	50,97881	14,65657	107,876	152,6415

Peramalan Regresi Linier Berganda 4 Prediktor Kota Bassel Swiss

Intensitas Radiasi Matahari (W / m^2)					
70% - 30%	**75% - 25%**	**80% - 20%**	**85% - 15%**	**90% - 10%**	**95% - 5%**
621,7623	174,1342	-29,7434	173,1419	168,862	254,8022
636,2476	101,4734	-41,9475	299,8439	284,8193	186,3001
644,447	85,95638	-41,3556	361,4078	286,644	155,3561
651,2572	78,22574	-34,3514	84,54454	419,9322	129,6605
652,3651	72,68814	-28,0377	119,973	474,4749	139,0814
649,705	53,02082	-15,143	345,9697	472,0864	141,6466
642,4713	16,10067	24,68242	490,6857	471,061	136,3307
629,8582	10,54879	31,96139	481,0243	470,334	125,7225
420,6529	10,66022	26,30325	486,9967	316,46	132,4539
245,9228	1,222307	33,24385	192,2752	165,2366	128,3113
222,3315	-2,48371	29,24896	252,4258	155,2113	113,0729
203,6961	-5,89827	35,82356	396,4236	144,3902	108,5874
193,8645	-10,3815	55,66624	413,7572	138,0634	113,8561
200,9203	125,2318	69,86553	361,3597	124,6772	268,8072
193,7901	298,3149	60,95837	113,4444	124,1014	460,1118
181,0584	367,1428	56,85744	86,90057	128,4178	490,4644
177,9776	403,7986	47,86638	110,9195	129,1743	508,2381
281,0729	423,9789	47,35191	106,1562	124,8187	524,7205
505,7998	449,7253	44,47075	97,57344	124,243	547,2722
517,0179	454,5271	33,82383	76,30973	139,4799	549,3435
548,7672	469,8498	32,74788	48,87819	252,7032	550,3658
578,4014	479,7734	34,61579	28,15162	301,6558	517,3147
605,4377	486,5883	35,33216	40,74557	334,068	510,5597
627,8617	486,6297	28,0237	35,69059	469,8294	500,3919
642,7706	179,3487	24,71198	31,83028	480,5679	188,5696
659,7146	113,1172	19,26496	31,59494	514,6578	168,55
667,5112	82,88757	7,018415	32,5952	519,8694	162,454
671,762	67,05057	2,050836	34,95641	521,6599	162,0875
672,7484	57,90411	-0,09828	35,90038	524,4155	150,262
670,7934	46,56461	-2,28981	55,73407	523,7192	129,4858
667,5705	41,7485	0,134049	71,30325	520,6959	119,6844
658,1417	39,16686	3,776748	68,25137	515,7912	118,9547
440,3724	37,55673	3,480794	80,39001	360,8866	117,1256
252,6736	32,74062	5,256513	370,2387	205,4948	113,2252
224,9323	26,89729	272,1803	410,15	179,7591	109,4223
225,9809	17,11221	341,1745	405,7192	162,813	114,9096
234,7639	7,132819	347,1894	397,1493	161,1613	118,5679
230,6938	150,7737	330,6996	354,7669	163,7656	120,2255
233,801	378,5223	218,3629	48,08253	164,5173	136,0994
230,1159	399,2583	40,88979	43,26289	160,621	156,6065

Peramalan Short Term

BMKG (W / m^2)			Bassel (W / m^2)		
ANFIS	**Regresi**	**Aktual**	**ANFIS**	**Regresi**	**Aktual**
0	0	0	0	22,10243	59,61131
0	0	0	0	12,42022	42,6648
0	0	0	0	5,521829	34,62267
0	0	0	0	-0,73866	26,87372
0	0	0	0	-5,28141	22,40556
0	0	0	0	0,846744	37,71191
76,46866	5,079343	50,5	0	11,72738	52,5798
91,50903	118,2306	255,3	0	12,45641	52,89345
120,8139	160,6624	298,1	0	175,7128	159,2846
215,8019	245,5258	443,1	24,03	260,1282	187,0058
268,0567	287,9576	360,7	141,51	329,5011	210,2432
268,0567	287,9576	351,2	245,64	346,605	204,2155
233,4255	259,6698	325,5	312,39	325,5934	187,965
120,8139	160,6624	226,8	332,86	306,7381	243,6001
91,50903	118,2306	142,6	306,16	122,5026	156,9045
109,3143	146,5185	156,1	240,3	55,02774	68,71304
99,53737	132,3746	81,9	145,96	275,6708	193,6416
91,50903	118,2306	19,4	34,71	285,5151	201,4852
0	0	0	0	32,92441	51,4657
0	0	0	0	7,827541	30,52393
0	0	0	0	-7,26752	1,338373
0	0	0	0	-20,3353	-14,25
0	0	0	0	-23,9031	-13,2354
0	0	0	0	-30,1773	-18,3896

Hasil Percobaan Variasi Jumlah Membership Function pada setiap Jenis Membership Function

Jumlah MF 5

Intensitas Radiasi Matahari(W/m^2)		
	RMSE	**MAE**
gaussmf	128,6646	101,5313
gbellmf	130,4714	104,9849
gauss2mf	**128,2806**	**100,5849**
pimf	132,8514	106,9626
trapmf	127,3451	103,442

Jumlah MF 8

Intensitas Radiasi Matahari(W/m^2)		
	RMSE	**MAE**
gaussmf	5977,4	1098,1
gbellmf	2353,7	531,9423
gauss2mf	63915	10617
pimf	141,6111	105,5081
trapmf	**132,7788**	**104,2165**

Jumlah MF 6

Intensitas Radiasi Matahari(W/m^2)		
	RMSE	**MAE**
gaussmf	227,1335	135,2878
gbellmf	314,0627	159,1793
gauss2mf	132,0282	99,2942
pimf	**119,7547**	**96,8625**
trapmf	162,0089	106,6442

Jumlah MF 9

Intensitas Radiasi Matahari(W/m^2)		
	RMSE	**MAE**
gaussmf	58581	9816,1
gbellmf	15465	2928,8
gauss2mf	193,4859	127,9574
pimf	165,0548	120,9404
trapmf	**148,6315**	**111,2009**

Jumlah MF 7

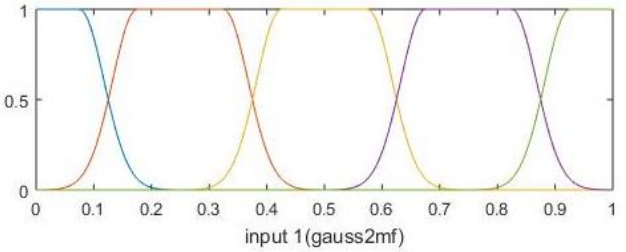
Intensitas Radiasi Matahari(W/m^2)		
	RMSE	**MAE**
gaussmf	233,9734	138,2098
gbellmf	137,2489	111,7572
gauss2mf	369,234	157,6127
pimf	207,2081	121,8139
trapmf	**137,0767**	**107,0654**

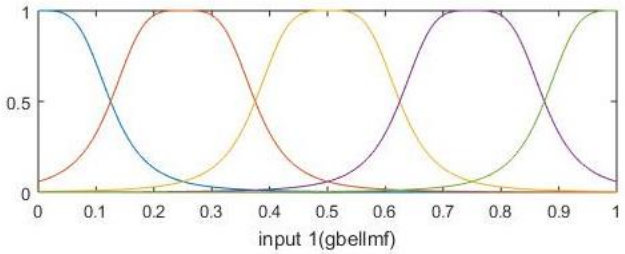
MF	**RMSE (W/m^2)**				
	Mf 5	**Mf 6**	**Mf 7**	**Mf 8**	**Mf 9**
gaussmf	**128,6646**	227,1335	233,9734	5977,4	58581
gbellmf	**130,4714**	314,0627	137,2489	2353,7	15465
gauss2mf	**128,2806**	132,0282	369,234	63915	193,4859
pimf	132,8514	**119,7547**	207,2081	141,6111	165,0548
trapmf	**127,3451**	162,0089	137,0767	132,7788	148,6315
MF	**MAE (W/m^2)**				
	Mf 5	**mf6**	**mf7**	**mf8**	**mf9**
gaussmf	**101,5313**	135,2878	138,2098	1098,1	9816,1
gbellmf	**104,9849**	159,1793	111,7572	531,9423	2928,8
gauss2mf	100,5849	**99,2942**	157,6127	10617	127,9574
pimf	106,9626	**96,8625**	121,8139	105,5081	120,9404
trapmf	**103,442**	106,6442	107,0654	104,2165	111,2009

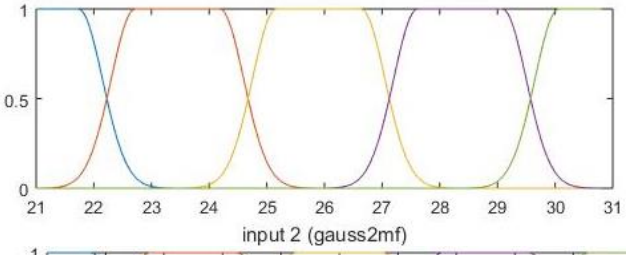
LAMPIRAN 4 Kurva Fungsi Keanggotaan Input Percobaan Variasi Jenis *Membership Functiom*

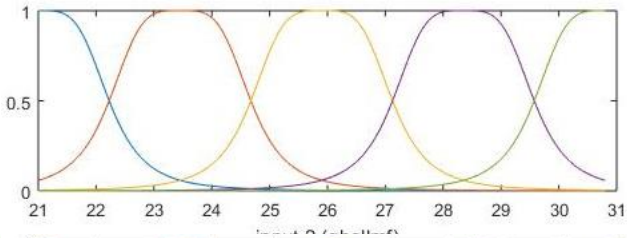
*) Input 1 = Lama Penyinaran Matahari *)Input 2 = Temperature

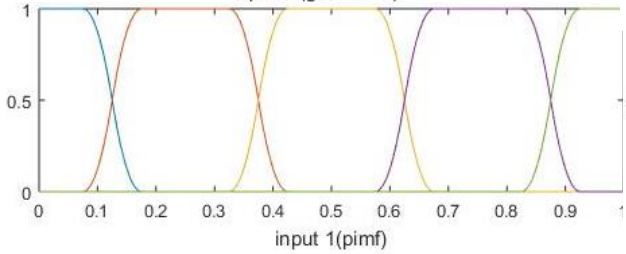
Kurva Fungsi Keanggotaan dengan jumlah fungsi keanggotaan 5

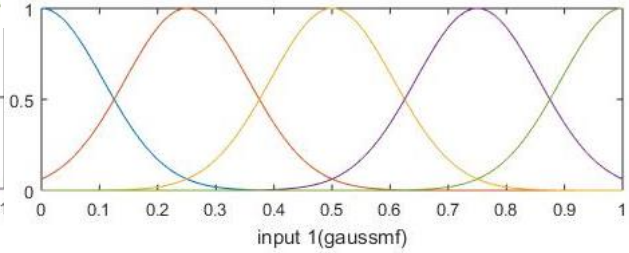


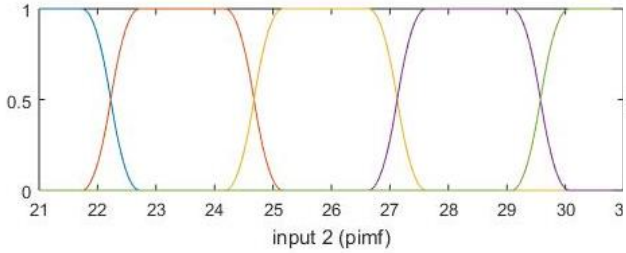


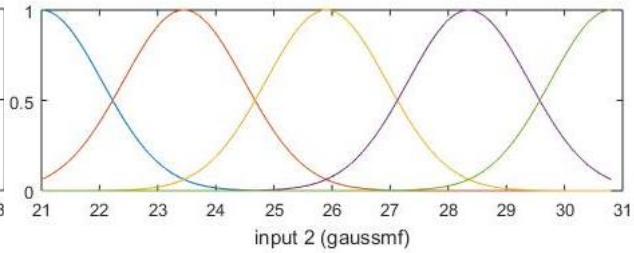


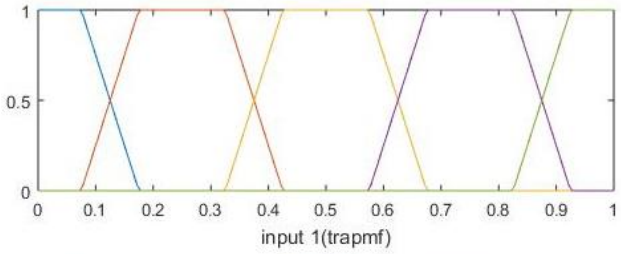


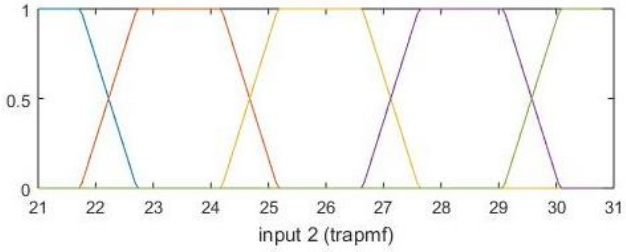






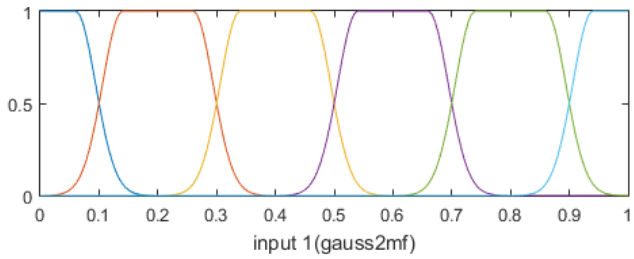


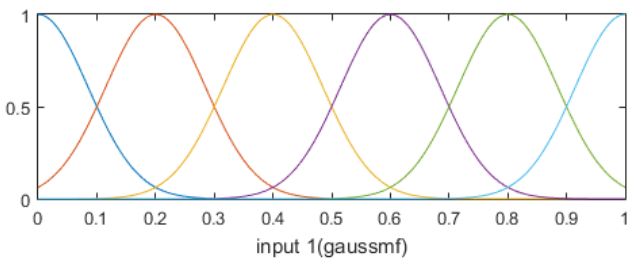


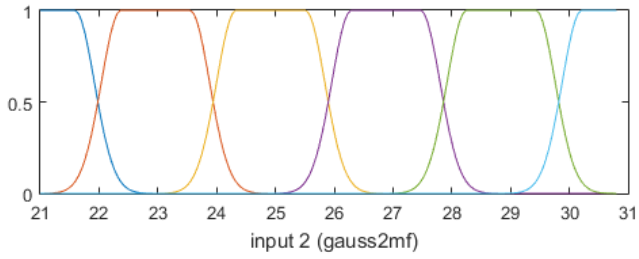


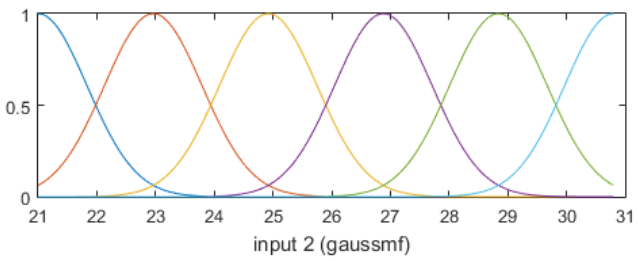
*) Input 1 = Lama Penyinaran Matahari *)Input 2 = Temperature

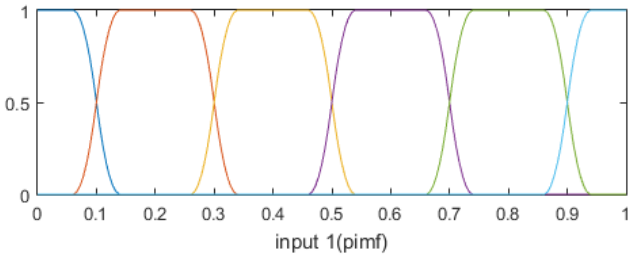
Kurva Fungsi Keanggotaan dengan jumlah fungsi keanggotaan 6

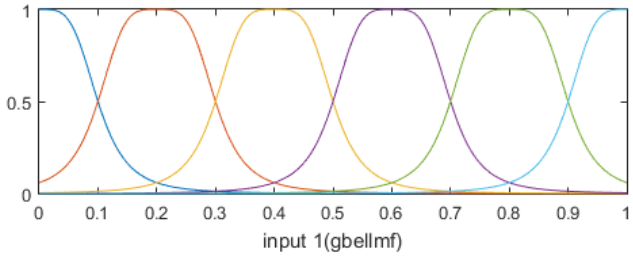


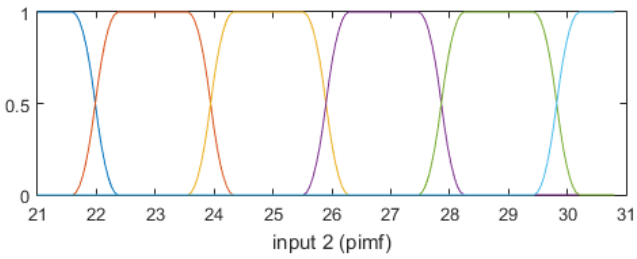


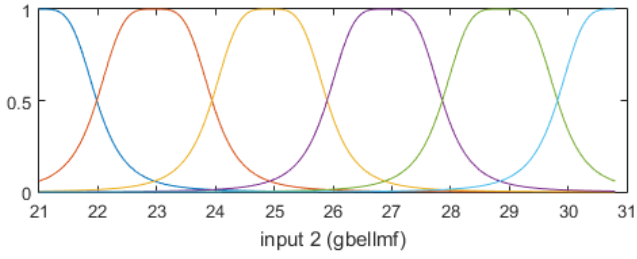


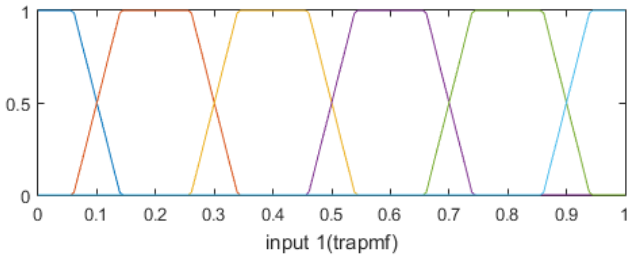


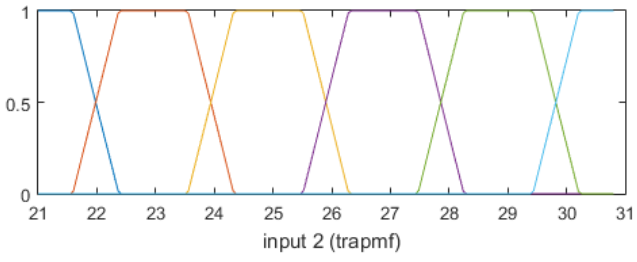






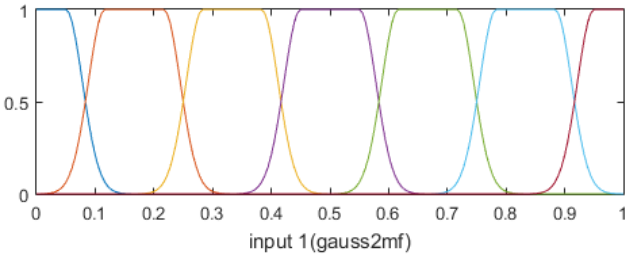


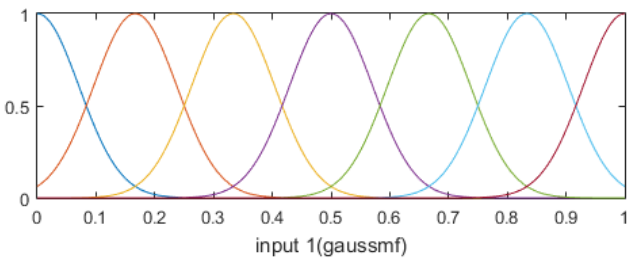


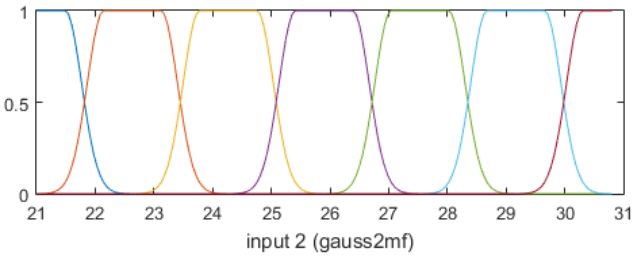


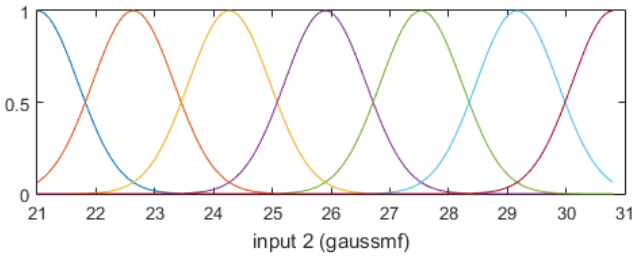
*) Input 1 = Lama Penyinaran Matahari *)Input 2 = Temperature

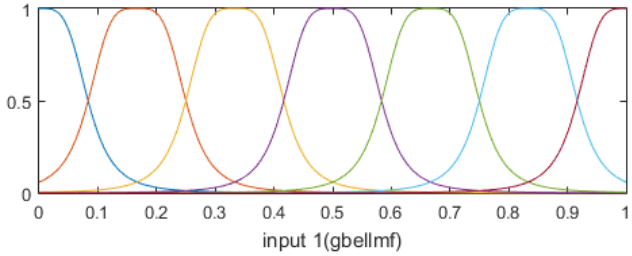
Kurva Fungsi Keanggotaan dengan jumlah fungsi keanggotaan 7

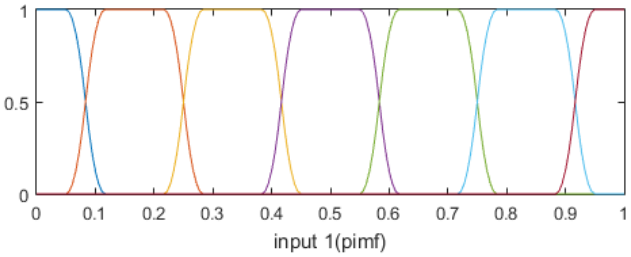


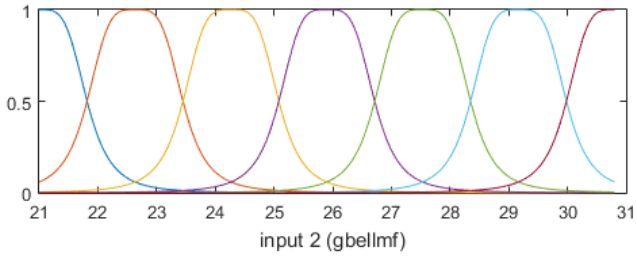


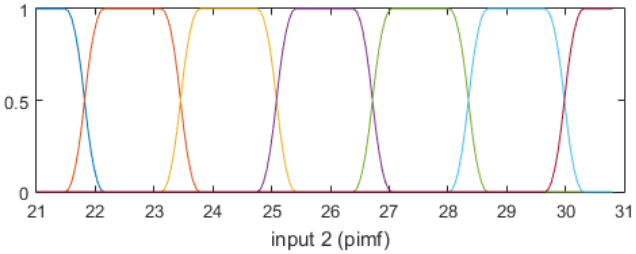


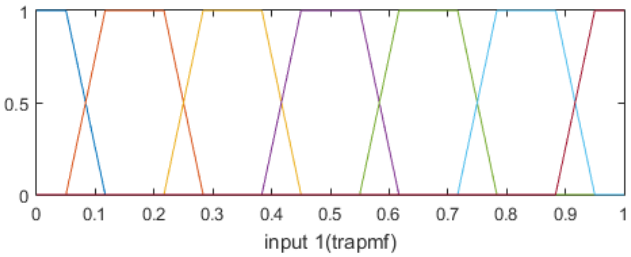


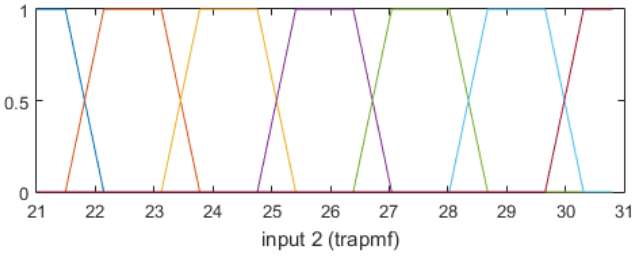






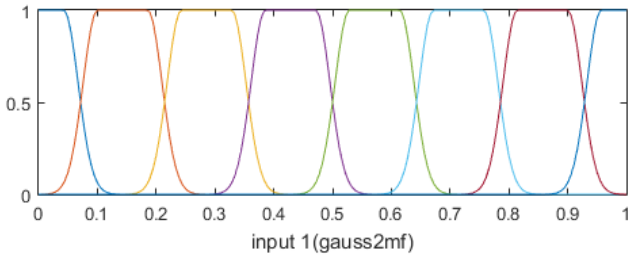


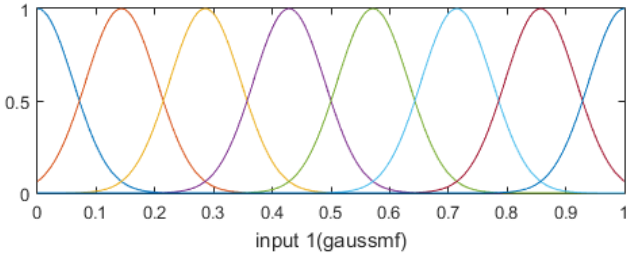


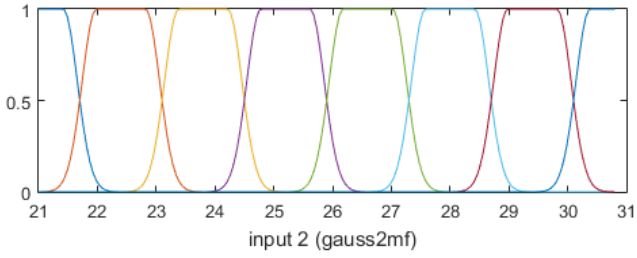


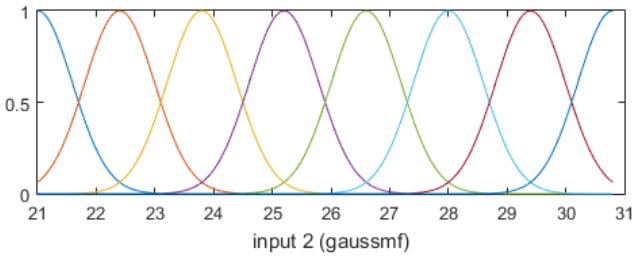
*) Input 1 = Lama Penyinaran Matahari *)Input 2 = Temperature

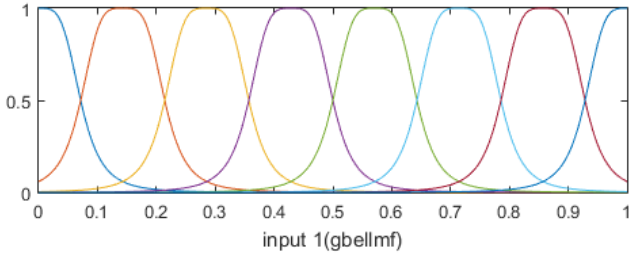
Kurva Fungsi Keanggotaan dengan jumlah fungsi keanggotaan 8

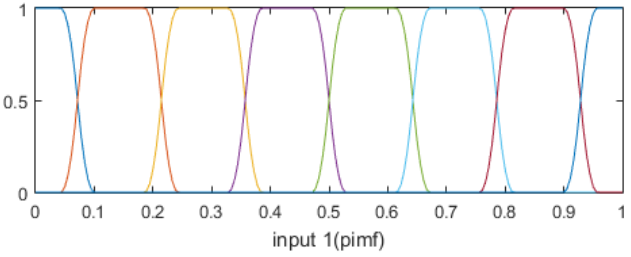


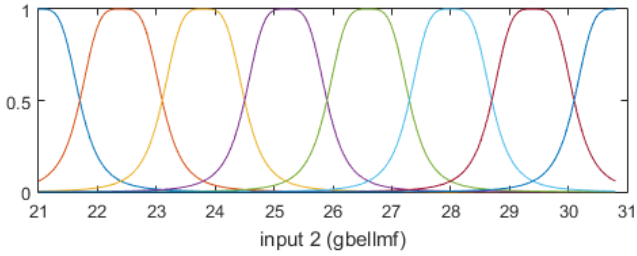


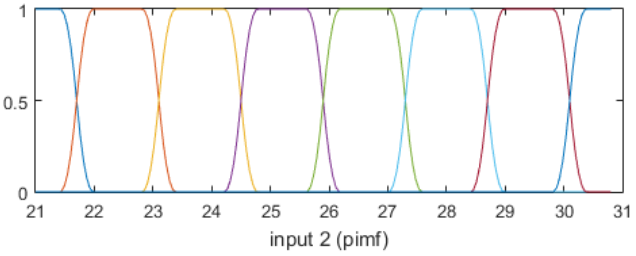


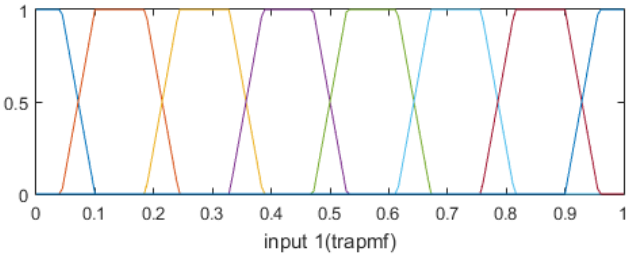


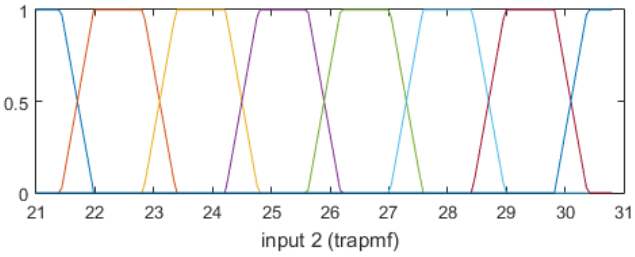






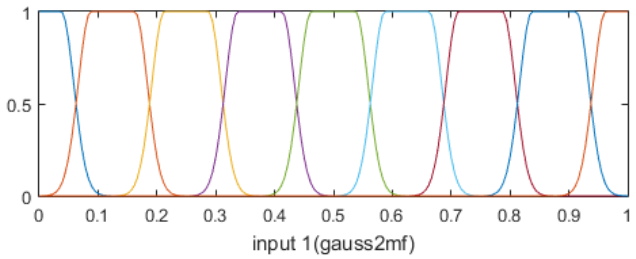


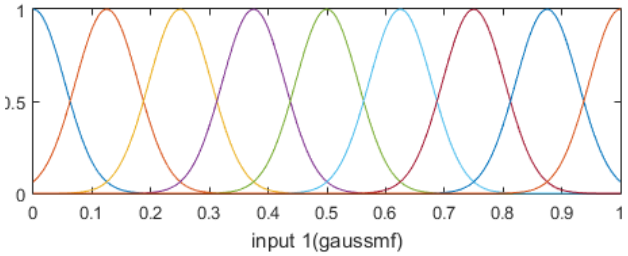


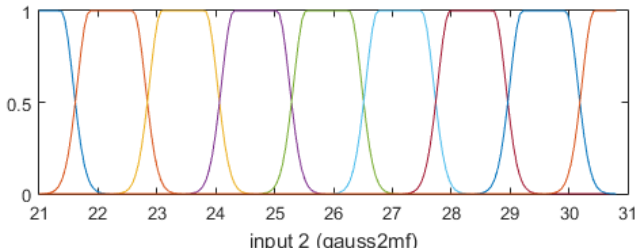


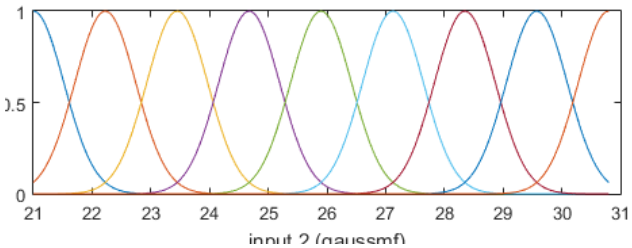
*) Input 1 = Lama Penyinaran Matahari *)Input 2 = Temperature

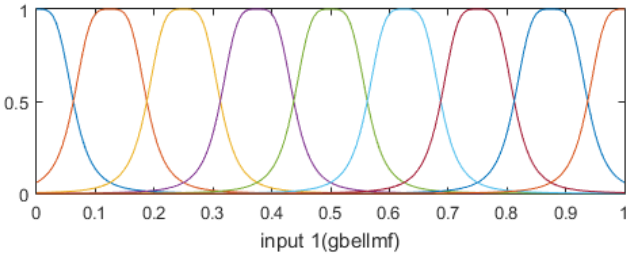
Kurva Fungsi Keanggotaan dengan jumlah fungsi keanggotaan 9

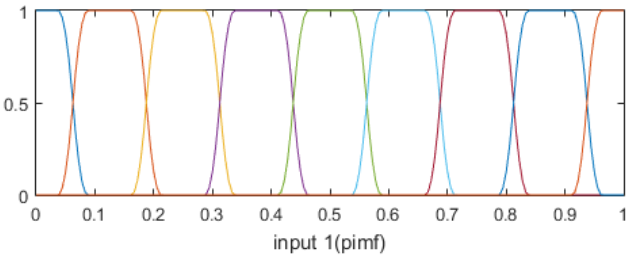


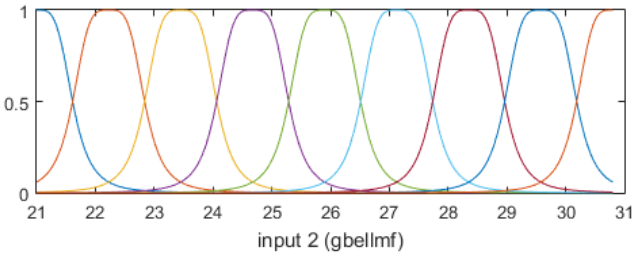


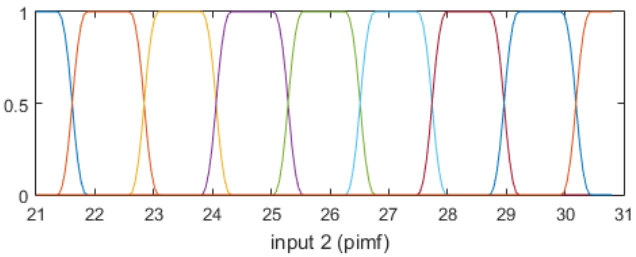


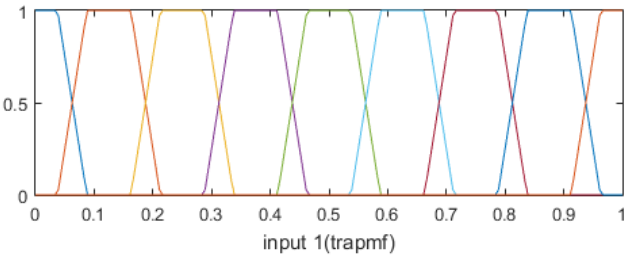


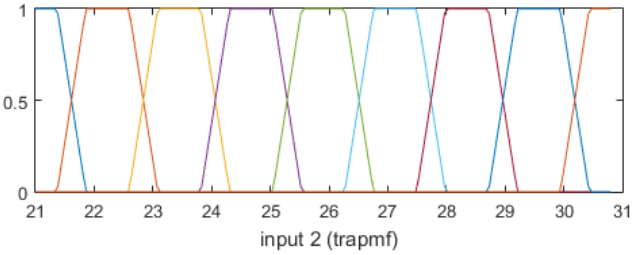












LAMPIRAN 5 Waktu Proses *Running* Program

Program	**Waktu(s)**
BMKG	
ANFIS	
Variasa Komposisi Data	2,797
Variasi Jumlah *MembershipFunction*	50,994
Variasi Jenis *MembershipFunction*	11,141
Regresi Linier Berganda	4,873
Bassel	
Variasi Komposisi Data ANFIS	
70% - 30%	492,262
75% - 25%	521,911
80% - 20%	510,211
85% - 15%	536,809
90% - 10%	381,934
95% - 05%	578,296
Variasi Komposisi Data Regresi Linier Berganda	
70% - 30%	0,638
75% - 25%	0,627
80% - 20%	0,658
85% - 15%	0,688
90% - 10%	0,655
95% - 05%	0,638
SHORT TERM	
Kota Malang (BMKG)	1,208
Kota Bassel (NOAA)	171,683

Screenshot Waktu *Running* Program

Profile Summary

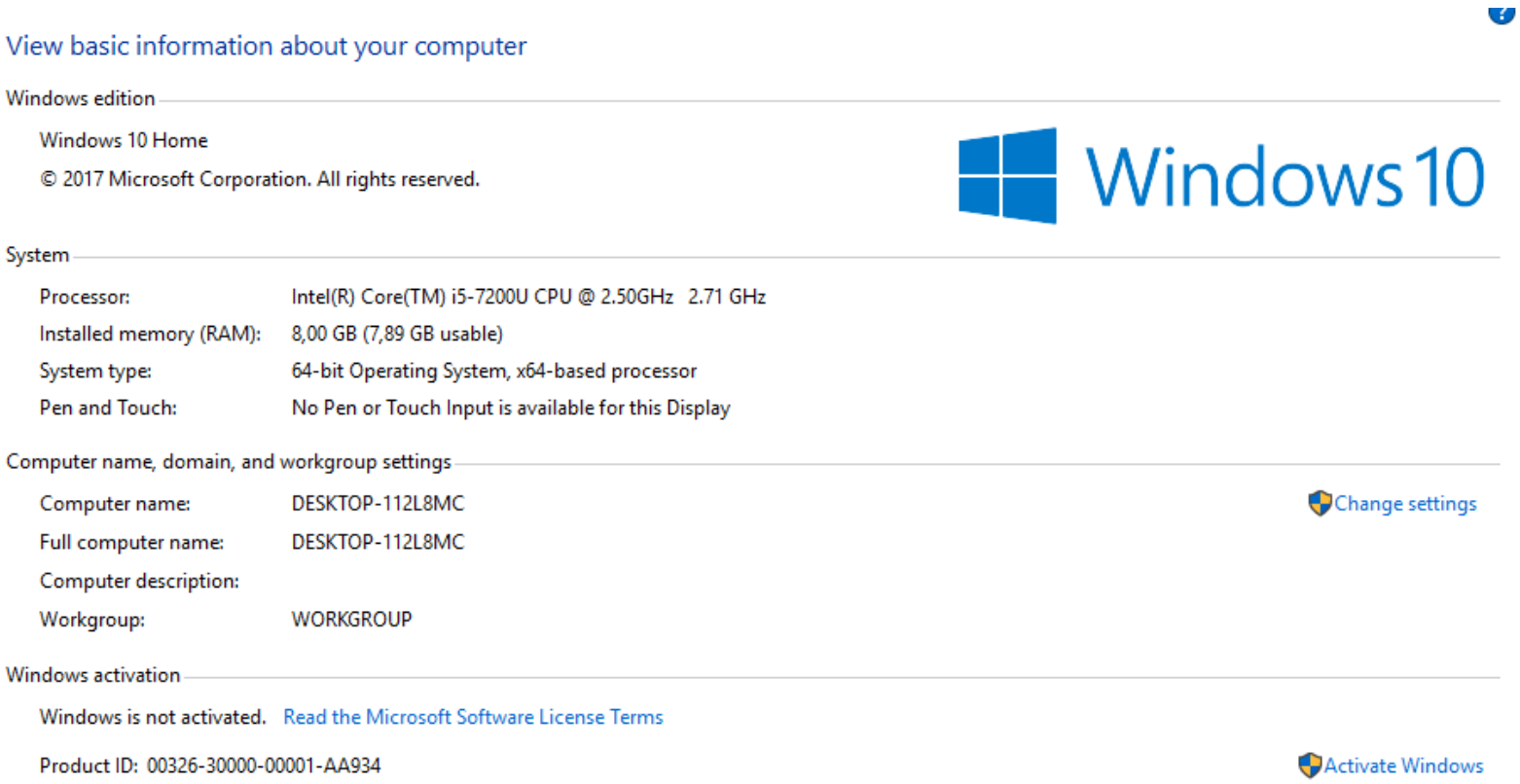
Generated 18-Apr-2018 20:33:57 using cpu time.

Function Name	Calls	**Total Time**	Self Time*	Total Time Plot (dark band = self time)
PeramalanShortTermBassel	1	171.683 s	0.136 s	
genfis2	1	166.406 s	0.062 s	
subclust	1	166.344 s	165.510 s	
anfis	1	4.372 s	0.018 s	
anfismex (MEX-file)	1	4.349 s	4.349 s	
waitbar	527	0.818 s	0.257 s	
legend	1	0.384 s	0.015 s	
...ndHGUsingMATLABClasses>make_legend	1	0.369 s	0.058 s	
scr...private\legendHGUsingMATLABClasses	1	0.369 s	0.000 s	
allchild	526	0.343 s	0.218 s	
close	2	0.176 s	0.004 s	
uitools\private\uiwaitbar	527	0.161 s	0.091 s	
xlabel	1	0.154 s	0.065 s	
Legend.Legend>Legend.Legend	1	0.154 s	0.002 s	
waitbar>updateWaitbar	526	0.139 s	0.006 s	
close>request_close	2	0.128 s	0.005 s	
Legend.doSetup	1	0.120 s	0.001 s	
fisgui	1	0.096 s	0.094 s	

Profile Summary

Generated 18-Apr-2018 20:29:51 using cpu time.

Function Name	Calls	**Total Time**	Self Time*	Total Time Plot (dark band = self time)
PeramalanShortTermBMKG	1	1.208 s	0.213 s	
legend	1	0.426 s	0.008 s	
scr...private\legendHGUsingMATLABClasses	1	0.418 s	0.057 s	
...ndHGUsingMATLABClasses>make_legend	1	0.360 s	0.011 s	
anfis	1	0.216 s	0.020 s	
anfismex (MEX-file)	1	0.190 s	0.190 s	
Legend.Legend>Legend.Legend	1	0.185 s	0.014 s	
close	1	0.175 s	0.007 s	
Legend.doSetup	1	0.138 s	0.038 s	
Legend.Legend>Legend.set.Axes	1	0.127 s	0.001 s	
Legend.Legend>Legend.set.Axes_I	1	0.124 s	0.003 s	
Legend.Legend>Legend.setAxesImpl	1	0.121 s	0.005 s	
close>request_close	1	0.113 s	0.011 s	
Legend.addToLayout	1	0.110 s	0.018 s	
legendcolorbarlayout	1	0.090 s	0.003 s	
fisgui	1	0.089 s	0.089 s	
...endcolorbarlayoutHGUsingMATLABClasses	1	0.087 s	0.017 s	
genfis2	1	0.071 s	0.048 s	



View basic information about your computer

Windows edition

Windows 10 Home

© 2017 Microsoft Corporation. All rights reserved.

Windows 10

System

Processor:	Intel(R) Core(TM) i5-7200U CPU @ 2.50GHz 2.71 GHz
Installed memory (RAM):	8,00 GB (7,89 GB usable)
System type:	64-bit Operating System, x64-based processor
Pen and Touch:	No Pen or Touch Input is available for this Display

Computer name, domain, and workgroup settings

Computer name:	DESKTOP-112L8MC
Full computer name:	DESKTOP-112L8MC
Computer description:	
Workgroup:	WORKGROUP

Change settings

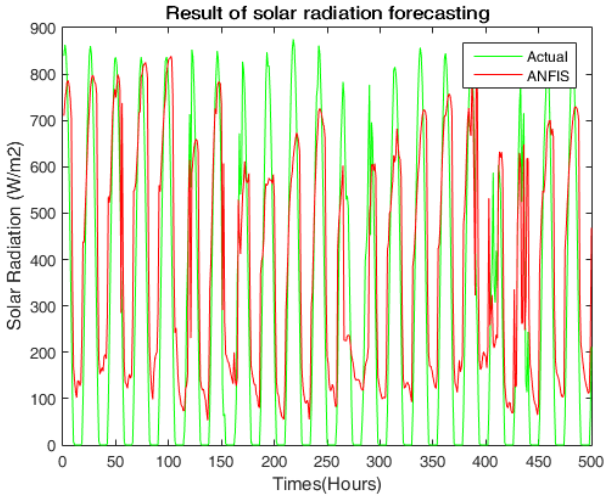
Windows activation

Windows is not activated. Read the Microsoft Software License Terms

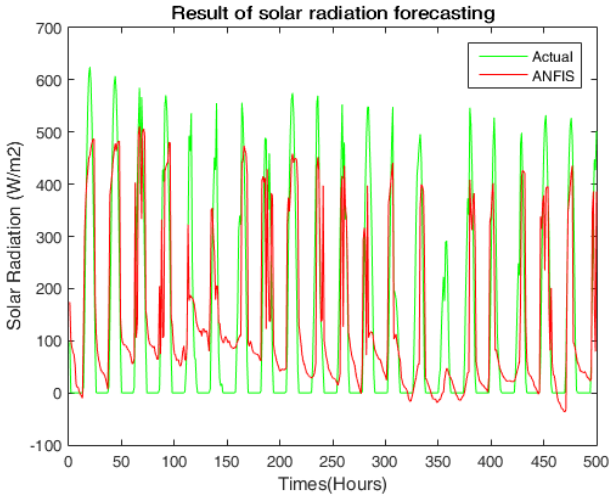
Product ID: 00326-30000-00001-AA934

Activate Windows

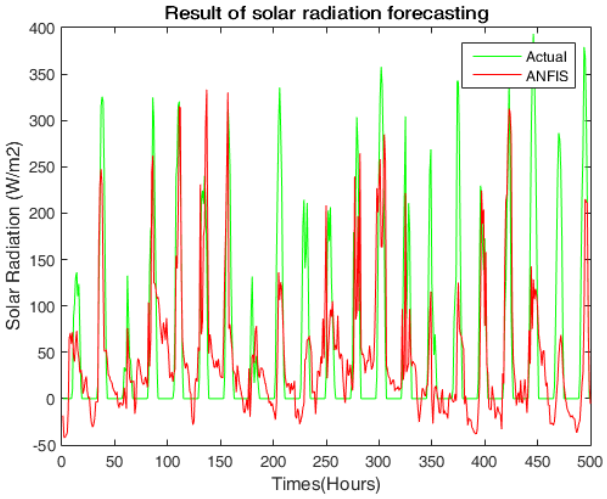
LAMPIRAN 6 Grafik Peramalan Kota Bassel



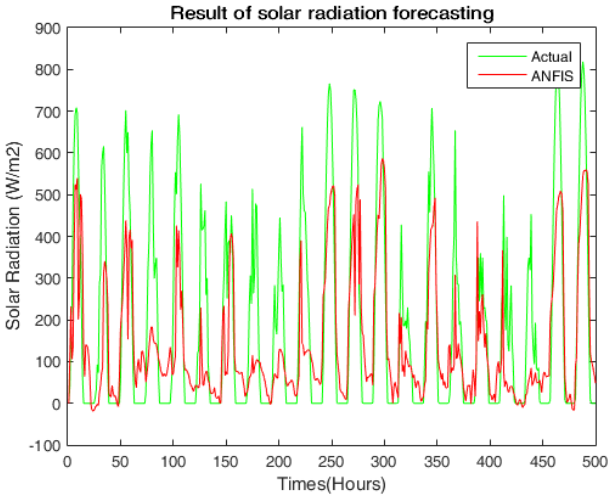
Hasil Peramalan Metode ANFIS 70%-30%



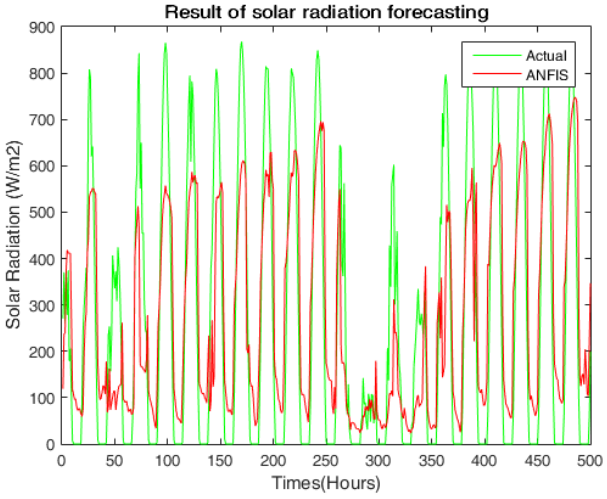
Hasil Peramalan Metode ANFIS 75%-25%



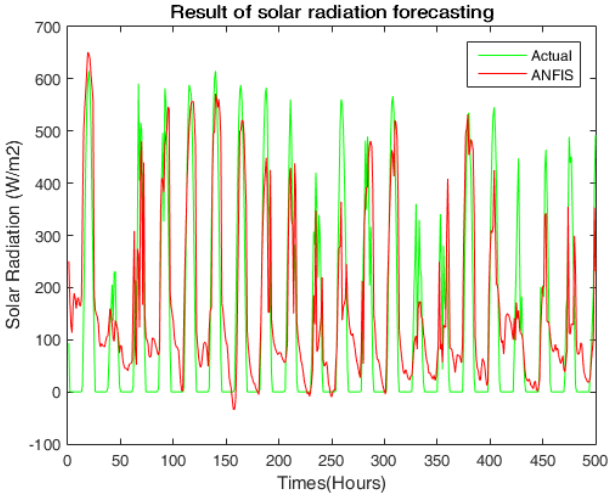
Hasil Peramalan Metode ANFIS 80%-20%



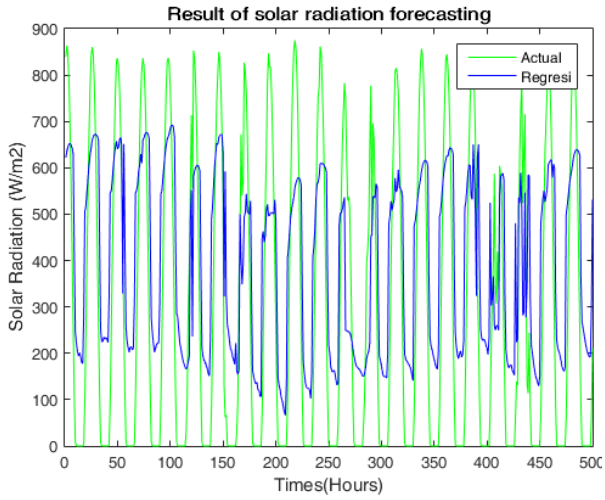
Hasil Peramalan Metode ANFIS 85%-15%



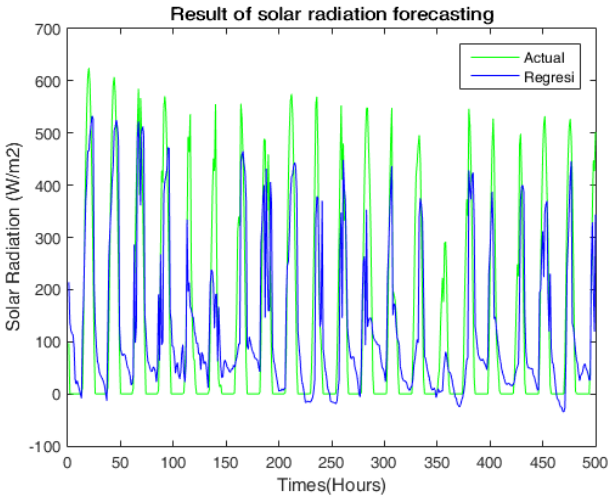
Hasil Peramalan Metode ANFIS 90%-10%



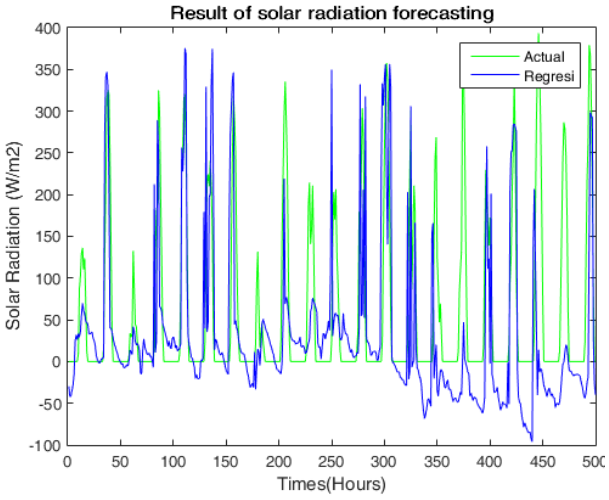
Hasil Peramalan Metode ANFIS 95%-05%



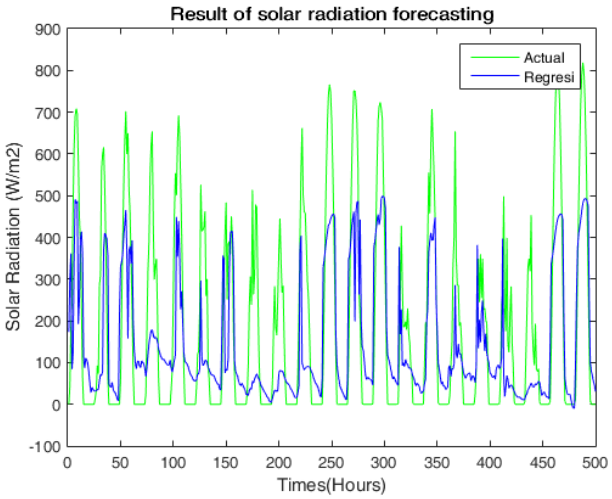
Hasil Peramalan Metode Regresi 70%-30%



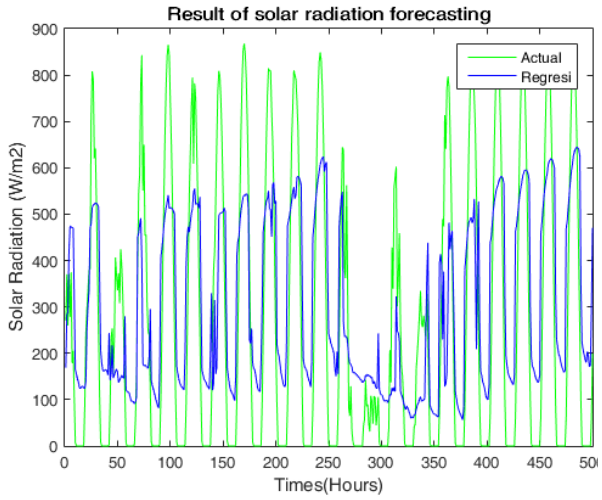
Hasil Peramalan Metode Regresi 75%-25%



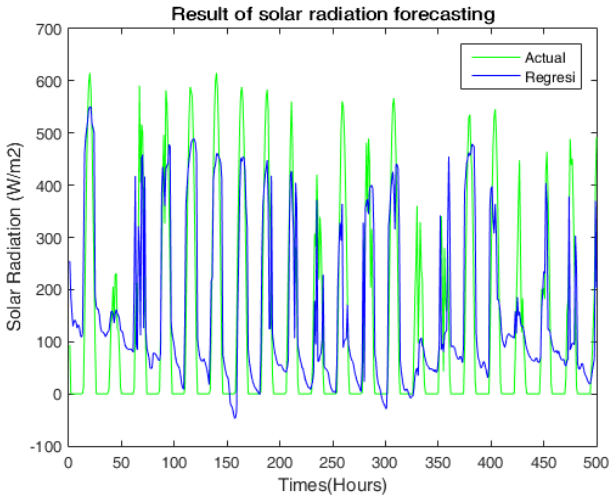
Hasil Peramalan Metode Regresi 80%-20%



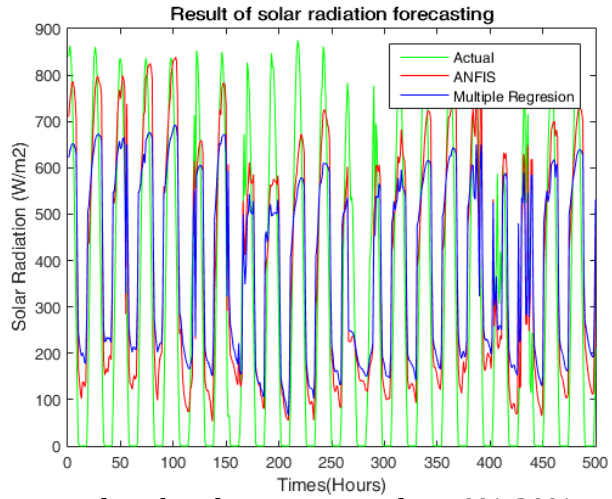
Hasil Peramalan Metode Regresi 85%-15%



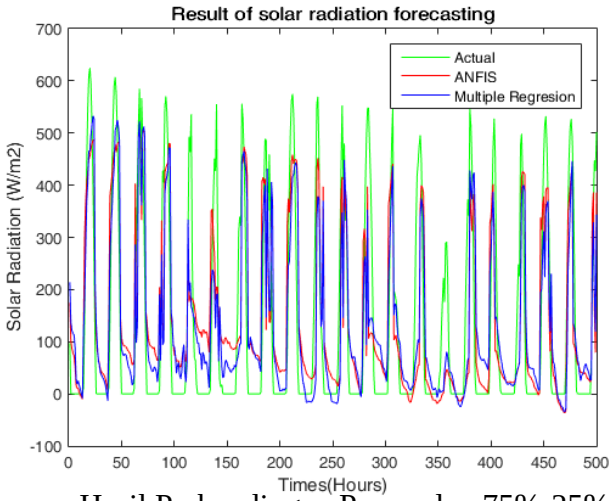
Hasil Peramalan Metode Regresi 90%-10%



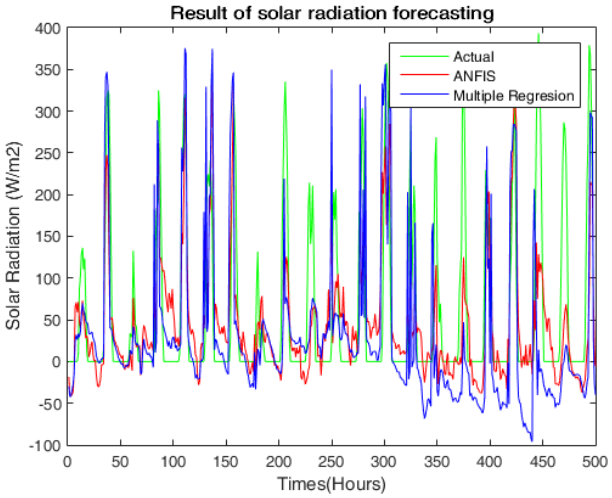
Hasil Peramalan Metode Regresi 95%-5%



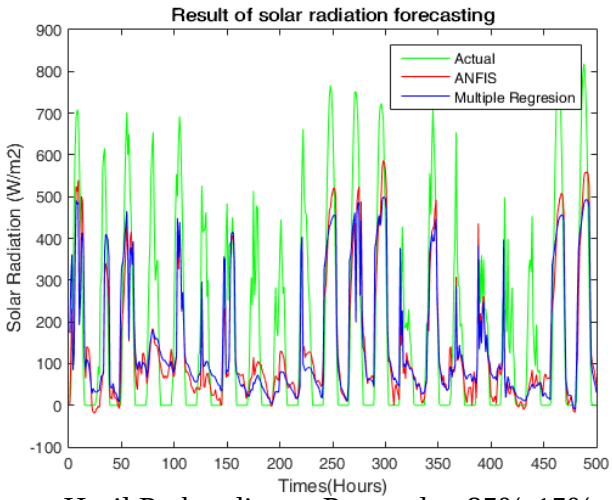
Hasil Perbandingan Peramalan 70%-30%



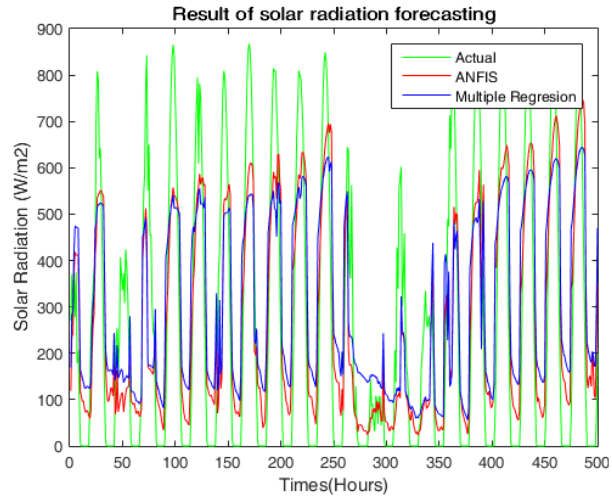
Hasil Perbandingan Peramalan 75%-25%



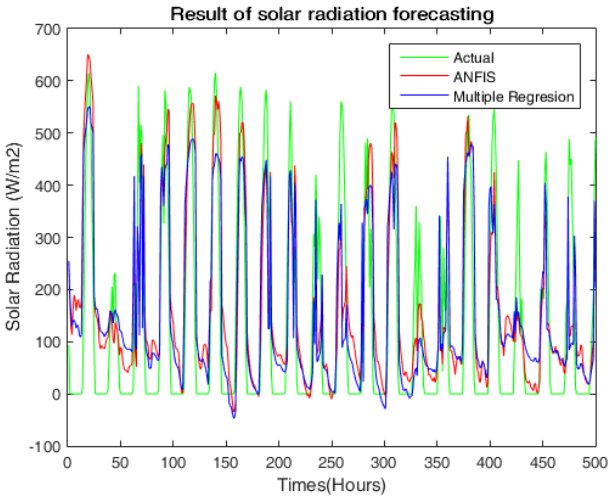
Hasil Perbandingan Peramalan 80%-20%



Hasil Perbandingan Peramalan 85%-15%



Hasil Perbandingan Peramalan 90%-10%



Hasil Perbandingan Peramalan 95%-15%