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LAMPIRAN

Lampiran 1 (Data yang digunakan)

Data Indeks Enso												
Tahun	Bulan											
	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Agu	Sep	Okt	Nov	Des
1995												-0,95
1996	-0,86	-0,86	-0,61	-0,47	-0,38	-0,44	-0,44	-0,22	-0,45	-0,44	-0,41	-0,64
1997	-0,53	-0,37	-0,25	0,16	0,64	1,09	1,56	1,89	2,13	2,36	2,41	2,29
1998	2,38	2,03	1,34	0,78	0,57	-0,39	-0,99	-1,28	-1,26	-1,46	-1,46	-1,69
1999	-1,69	-1,32	-0,95	-1,11	-1,15	-1,19	-1,17	-1,22	-1,09	-1,23	-1,58	-1,74
2000	-1,77	-1,55	-0,98	-0,87	-0,86	-0,79	-0,67	-0,49	-0,52	-0,7	-0,79	-0,92
2001	-0,73	-0,63	-0,48	-0,49	-0,34	-0,19	-0,04	-0,05	-0,2	-0,14	-0,37	-0,41
2002	-0,15	-0,04	0,01	0,02	0,31	0,72	0,74	0,87	1,09	1,25	1,47	1,37
2003	0,6	0,64	0,36	-0,14	-0,61	-0,29	0,21	0,26	0,27	0,42	0,33	0,43
2004	0,27	0,23	0,12	0,07	0,06	0,13	0,49	0,76	0,81	0,73	0,66	0,74
2005	0,66	0,36	0,45	0,26	0,3	0,04	-0,23	-0,05	-0,04	-0,06	-0,59	-0,92
2006	-0,91	-0,67	-0,71	-0,32	-0,09	0	0,01	0,31	0,6	0,7	0,99	1,14
2007	0,7	0,13	-0,18	-0,32	-0,47	-0,35	-0,59	-0,72	-1,11	-1,39	-1,54	-1,58
2008	-1,68	-1,67	-1,21	-0,99	-0,84	-0,68	-0,3	-0,13	-0,25	-0,35	-0,46	-0,86
2009	-0,89	-0,79	-0,69	-0,35	0,06	0,31	0,48	0,56	0,68	0,89	1,46	1,74
2010	1,52	1,25	0,9	0,38	-0,22	-0,69	-1,07	-1,39	-1,6	-1,69	-1,64	-1,6
2011	-1,54	-1,11	-0,93	-0,77	-0,52	-0,38	-0,43	-0,65	-0,8	-1,05	-1,19	-1,06
2012	-0,87	-0,67	-0,61	-0,5	-0,32	0,02	0,25	0,47	0,38	0,26	0,16	-0,25
2013	-0,53	-0,52	-0,25	-0,25	-0,4	-0,42	-0,39	-0,38	-0,18	-0,2	-0,14	-0,17
2014	-0,49	-0,62	-0,28	0,08	0,32	0,23	-0,06	-0,03	0,29	0,44	0,75	0,71
2015	0,51	0,42	0,47	0,7	0,92	1,18	1,46	1,93	2,21	2,36	2,72	2,66
2016	2,57	2,26	1,62	0,91	0,3	-0,03	-0,48	-0,58	-0,58	-0,74	-0,76	-0,5
2017	-0,43	-0,08	0,03	0,22	0,37	0,34	0,25	-0,16	-0,43	-0,56	-0,97	-0,98
2018	-0,98	-0,78	-0,8	-0,51	-0,2	0,04	0,12	0,09	0,47	0,9	0,9	0,89
2019	0,65	0,71	0,81	0,62	0,55	0,45	0,35	0,04	0,03	0,48	0,52	0,52
2020	0,6	0,37	0,48	0,36	-0,27	-0,34	-0,3	-0,59	-0,83	-1,26	-1,42	-1,15
2021	-1	-1	-0,8	-0,72	-0,46	-0,28	-0,39	-0,53	-0,55	-0,94	-0,94	-1,06
2022	-0,94	-0,89	-0,97	-1,11	-1,11	-0,75	-0,69	-0,97	-1,07	-0,99	-0,9	-0,85
2023	-0,71	-0,46	-0,11	0,14	0,46	0,84	1,03	1,31	1,59			



Lampiran 2 (Persamaan Prediksi)

$$\text{UJI 1 } N(t+1) = 0.84579 * N(t) + -0.0014321 * N(t-1) + \dots + -0.17225 * N(t-160) + -0.035362$$

$$\text{UJI 2 } N(t+2) = -0.82654 * N(t) + 1.065 * N(t-1) + \dots + -0.48447 * N(t-160) + 0.059552$$

$$\text{UJI 3 } N(t+3) = 0.37277 * N(t) + -0.90899 * N(t-1) + \dots + -0.66988 * N(t-160) + 0.064993$$

$$\text{UJI 4 } N(t+4) = -0.11534 * N(t) + -0.25394 * N(t-1) + \dots + 0.59909 * N(t-160) + -0.78871$$

$$\text{UJI 5 } N(t+5) = 0.3408 * N(t) + 0.57926 * N(t-1) + \dots + -0.00093516 * N(t-160) + 1.261$$

$$\text{UJI 6 } N(t+6) = -0.14543 * N(t) + 0.55318 * N(t-1) + \dots + -0.23021 * N(t-160) + -0.12896$$

$$\text{UJI 7 } N(t+7) = -0.84675 * N(t) + 0.10272 * N(t-1) + \dots + 0.96081 * N(t-160) + -0.23141$$

$$\text{UJI 8 } N(t+8) = 0.56074 * N(t) + 0.90092 * N(t-1) + \dots + 0.92255 * N(t-160) + 0.4195$$

$$\text{UJI 9 } N(t+9) = 0.16034 * N(t) + 0.21339 * N(t-1) + \dots + -0.093935 * N(t-160) + 0.43708$$

$$\text{UJI 10 } N(t+10) = 0.89058 * N(t) + -0.63901 * N(t-1) + \dots + 0.057098 * N(t-160) + 0.098393$$

$$\text{UJI 11 } N(t+11) = -0.28126 * N(t) + 0.08918 * N(t-1) + \dots + -0.86044 * N(t-160) + -0.072329$$

$$\text{UJI 12 } N(t+12) = 0.87166 * N(t) + -0.033847 * N(t-1) + \dots + -0.05453 * N(t-160) + -0.245$$



Lampiran 3 (Script Pengolahan Data)

```
clc;clear;close all;warning off;

% Proses membaca data uji dari excel
filename = 'ENSO.xlsx';
sheet = 4;
xlRange = 'B4:FR164';

Data = xlsread(filename, sheet, xlRange);
data_uji = Data(:,1:161)';
target_uji = Data(:,162)';
[m,n] = size(data_uji);

% Pembuatan JST
net = newff(minmax(data_uji), [10 1], {'logsig', 'purelin'}, 'traingdx');

% Memberikan nilai untuk mempengaruhi proses peujian
net.performFcn = 'mse';
net.trainParam.goal = 0.0001;
net.trainParam.show = 20;
net.trainParam.epochs = 1000;
net.trainParam.mc = 0.99;
net.trainParam.lr = 0.1;

% Proses training
[net_keluaran,tr,Y,E] = train(net,data_uji,target_uji);

% Hasil setelah peujian
bobot_hidden = net_keluaran.IW{1,1};
bobot_keluaran = net_keluaran.LW{2,1};
bias_hidden = net_keluaran.b{1,1};
bias_keluaran = net_keluaran.b{2,1};
jumlah_iterasi = tr.num_epochs;
nilai_keluaran = (Y)';
nilai_error = (E)';
error_MSE = ((1/n)*sum(nilai_error.^2).^0.5);

save data_peujian1.mat net_keluaran

% Hasil prediksi
hasil_uji = sim(net_keluaran,data_uji);
max_data = 2.72;
min_data = -1.77;
hasil_uji = ((hasil_uji-0.1)*(max_data-min_data)/0.8)+min_data;

% Performansi hasil prediksi
filename = 'ENSO.xlsx';
sheet = 1;
xlRange = 'A144:A304';

target_uji_asli = xlsread(filename, sheet, xlRange);

% Menghitung hasil regresi
mdl = fitlm(target_uji_asli, hasil_uji);
coeff = mdl.Coefficients.Estimate;

% Koefisien persamaan regresi
intercept = coeff(1); % Intersep
slope = coeff(2); % Kemiringan (slope)

% Tampilkan persamaan regresi
s = sprintf('Output ~= %.2f*Target + %.2f', slope, intercept);

figure(1)
;
ssion(target_uji_asli, hasil_uji);
on = corrcoeff(target_uji_asli, hasil_uji);
lation(1, 2);
= ', num2str(R)], 'FontWeight', 'bold', 'FontSize', 12);
```



```

xlabel('Observed');
ylabel('Predicted');
legend('Line of Forecast', 'FIT', 'Data', 'orientation', 'horizontal');

figure(2),
plotperform(tr)

figure(3),
plot(hasil_uji, 'bo-')
hold on
plot(target_uji_asli, 'ro-')
hold on
grid on
title(strcat(['RMSE = ', ...
num2str(error_MSE), '°C']))
xlabel('Year')
ylabel('Nino 3.4 SST Anomaly (°C)')
legend('Predicted', 'Observed', 'Location', 'Best', 'orientation', 'horizontal')

% Mengatur x-tick dan x-label
tahun = 2009:2023;
set(gca, 'XTick', 1:12:167); % Anda perlu menyesuaikan ini dengan jumlah data Anda
set(gca, 'XTickLabel', tahun); % Menggunakan vektor tahun sebagai label x
equation = 'N(t+1) = ';

for i = 1:161
    if i == 1
        equation = strcat(equation, num2str(bobot_hidden(i)), ' * N(t)');
    else
        equation = strcat(equation, ' + ', num2str(bobot_hidden(i)), ' * N(t-',
num2str(i-1), ')');
    end
end

equation = strcat(equation, ' + ', num2str(bias_keluaran));
disp(equation);

```

