

LAPORAN PROJEK MULTIPLE LINIER REGRESSION

Disusun untuk memenuhi tugas mata kuliah

Sains Komputasi



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LATAR BELAKANG

Pasar valas merupakan salah satu pasar keuangan terbesar di dunia, dengan volume perdagangan mencapai triliunan dollar AS. Sejak peralihan dari standar emas ke sistem nilai tukar mengambang, pasar ini telah berkembang pesat. Dengan buka 24 jam 5 hari dalam seminggu, perdagangan berlangsung di seluruh zona waktu di dunia, memungkinkan pelaku pasar untuk memenuhi kebutuhan transaksi bisnis dan investasi. Nilai tukar mata uang pada pasar valas dipengaruhi oleh banyak faktor ekonomi, termasuk NFP, FOMC, dan CPI. Kebijakan moneter yang diterapkan oleh bank sentral, seperti Federal Reserve dan European Central Bank, juga memainkan peran penting dalam menentukan nilai tukar.

Pasar valas menyediakan berbagai mata uang dari seluruh dunia, seperti USD/CHF (Dolar AS/Franc Swiss), AUD/USD (Dolar Australia/Dolar AS), GBP/USD (Pound Inggris/Dolar AS), USD/JPY (Dolar AS/Yen Jepang), dan EUR/USD (Euro/Dolar AS). Salah satu pasangan mata uang yang paling aktif dari contoh tersebut adalah EUR/USD, yang menjadi pasangan mata uang paling populer di pasar valas.

Pasangan mata uang ini mencerminkan hubungan antara dua ekonomi terbesar di dunia, yaitu zona Eropa dan zona Amerika. EUR/USD memiliki volatilitas yang seimbang dan pola perdagangan yang lebih stabil. Dengan likuiditas yang tinggi, pelaku pasar dapat membeli dan menjual mata uang ini dengan cepat dan efisien, yang membuat spreadnya lebih rendah. EUR/USD adalah fokus utama bagi banyak analis keuangan, dengan berbagai laporan harian, mingguan, dan bulanan, menjadikannya pilihan utama bagi banyak pelaku pasar.

Model regresi linier berganda (MLR) menjadi alat yang berguna dalam memprediksi harga mata uang dengan mempertimbangkan beberapa variabel independen. Dalam konteks EUR/USD, variabel seperti rata-rata harga pembukaan, harga tertinggi, harga terendah, dan harga penutupan sebelumnya dapat digunakan untuk memahami pengaruhnya terhadap harga penutupan hari ini. Selain itu, integrasi variabel ekonomi yang signifikan dalam model MLR dapat meningkatkan akurasi prediksi harga. Evaluasi kinerja model MLR melalui metrik seperti R-squared dan RMSE menjadi penting dalam membantu trader membuat keputusan investasi yang lebih baik.

PENJELASAN DATASET

Data yang digunakan ada adalah data EUR/USD dalam rentang waktu 1 Januari 2024 sampai dengan 30 September 2024 sebanyak 170 data. Data ini diambil dari website [investing.com](https://www.investing.com) Harga pembukaan, harga tertinggi, harga terendah, dan harga penutupan adalah empat harga asli yang digunakan untuk mengekspresikan fluktuasi harga valas.

Date	Price	Open	High	Low
08/30/2024	1.1047	1.1077	1.1095	1.1044
08/29/2024	1.1077	1.1119	1.1141	1.1055
08/28/2024	1.1120	1.1184	1.1186	1.1105
08/27/2024	1.1184	1.1161	1.1191	1.1150
08/26/2024	1.1161	1.1188	1.1202	1.1150
08/23/2024	1.1190	1.1113	1.1200	1.1105

Price adalah harga penutupan hari itu, open adalah harga pembukaan hari itu, high adalah harga tertinggi hari itu, low adalah harga terendah hari itu. Data tersebut akan digunakan untuk memahami bagaimana perubahan pada variable independent mempengaruhi variable dependen.

Model multiple linier regression bisa dinyatakan dalam persamaan

$$Y = \alpha + \beta_1 \cdot x_1 + \beta_2 \cdot x_2 + \beta_3 \cdot x_3 + \dots + \beta_n \cdot x_n$$

Y = variabel dependen (target).

β_0 = intersep (nilai Y ketika semua X sama dengan nol).

$\beta_1, \beta_2, \dots, \beta_n$ = koefisien regresi untuk masing-masing variabel independen (X_1, X_2, \dots, X_n), yang menunjukkan seberapa besar pengaruh setiap X terhadap Y.

X_1, X_2, \dots, X_n = variabel independen (prediktor).

variable independen :

X1 = rata rata harga pembukaan 5 hari sebelumnya

X2 = rata rata harga tertinggi 5 hari sebelumnya

X3 = rata rata harga terendah 5 hari sebelumnya

X4 = rata rata harga penutupan 5 hari sebelumnya

Rata rata harga 5 hari sebelumnya dipilih karena rata-rata 5 hari membantu mengurangi dampak dari fluktuasi harga yang tajam atau lonjakan harga (spike) yang mungkin terjadi dalam satu hari. Ini memberikan gambaran yang lebih stabil dan dapat diandalkan tentang tren harga. Selain itu rata rata harga 5 hari sebelumnya cocok digunakan sebagai acuan untuk intraday.

Variable dependen :

Y = harga penutupan hari ini

Harga penutupan hari ini dipilih sebagai variabel dependen karena mencerminkan harga terakhir yang tercatat pada akhir sesi perdagangan, menggambarkan konsensus pasar dan keputusan akhir trader serta investor. Selain itu, harga penutupan mencerminkan reaksi terhadap berita dan informasi yang terjadi sepanjang hari, memberikan gambaran yang lebih baik tentang sentimen pasar.

Mencari x1 x2 x3 x4

x1	x2	x3	x4	y
1.11530	1.11840	1.11130	1.11464	1.10470

Mencari x1

$X1 = (\text{harga pembukaan 1 hari sebelumnya} + \text{harga pembukaan 2 hari sebelumnya} + \text{harga pembukaan 3 hari sebelumnya} + \text{harga pembukaan 4 hari sebelumnya} + \text{harga pembukaan 5 hari sebelumnya})/5$

$X1 = (1.1119 + 1.1184 + 1.1161 + 1.1188 + 1.1113)/5$

$X1 = 5,5675/5$

$$X1 = 1,1153$$

Mencari x2

$X2 = (\text{harga tertinggi 1 hari sebelumnya} + \text{harga tertinggi 2 hari sebelumnya} + \text{harga tertinggi 3 hari sebelumnya} + \text{harga tertinggi 4 hari sebelumnya} + \text{harga tertinggi 5 hari sebelumnya})/5$

$$X2 = (1.1141 + 1.1186 + 1.1191 + 1.1202 + 1.1200)/5$$

$$X2 = 5,592/5$$

$$X2 = 1,1184$$

Mencari x3

$X3 = (\text{harga terendah 1 hari sebelumnya} + \text{harga terendah 2 hari sebelumnya} + \text{harga terendah 3 hari sebelumnya} + \text{harga terendah 4 hari sebelumnya} + \text{harga terendah 5 hari sebelumnya})/5$

$$X3 = (1.1055 + 1.1105 + 1.1150 + 1.1150 + 1.1105)/5$$

$$X3 = 5,5565/5$$

$$X3 = 1.1113$$

Mencari x4

$X4 = (\text{harga penutupan 1 hari sebelumnya} + \text{harga penutupan 2 hari sebelumnya} + \text{harga penutupan 3 hari sebelumnya} + \text{harga penutupan 4 hari sebelumnya} + \text{harga penutupan 5 hari sebelumnya})/5$

$$X4 = (1.1077 + 1.1120 + 1.1184 + 1.1161 + 1.1190)/5$$

$$X4 = 5,5732/5$$

$$X5 = 1,11646$$

MANUALISASI

Data

Date	Price	Open	High	Low
08/30/2024	1.1047	1.1077	1.1095	1.1044
08/29/2024	1.1077	1.1119	1.1141	1.1055
08/28/2024	1.1120	1.1184	1.1186	1.1105
08/27/2024	1.1184	1.1161	1.1191	1.1150
08/26/2024	1.1161	1.1188	1.1202	1.1150
08/23/2024	1.1190	1.1113	1.1200	1.1105
08/22/2024	1.1112	1.1150	1.1165	1.1097
08/21/2024	1.1150	1.1128	1.1173	1.1099
08/20/2024	1.1130	1.1085	1.1130	1.1071
08/19/2024	1.1085	1.1024	1.1086	1.1022
08/16/2024	1.1028	1.0972	1.1030	1.0970
08/15/2024	1.0971	1.1012	1.1016	1.0949
08/14/2024	1.1012	1.0992	1.1048	1.0984
08/13/2024	1.0992	1.0932	1.0999	1.0913
08/12/2024	1.0931	1.0915	1.0940	1.0911
08/09/2024	1.0916	1.0919	1.0932	1.0909
08/08/2024	1.0918	1.0922	1.0946	1.0882
08/07/2024	1.0921	1.0928	1.0936	1.0905
08/06/2024	1.0930	1.0953	1.0964	1.0903
08/05/2024	1.0952	1.0922	1.1008	1.0892
08/02/2024	1.0908	1.0789	1.0927	1.0782
08/01/2024	1.0791	1.0826	1.0836	1.0776
07/31/2024	1.0825	1.0816	1.0850	1.0802
07/30/2024	1.0815	1.0821	1.0837	1.0797
07/29/2024	1.0819	1.0864	1.0870	1.0803
07/26/2024	1.0857	1.0847	1.0869	1.0841
07/25/2024	1.0844	1.0840	1.0870	1.0827

07/24/2024	1.0839	1.0854	1.0868	1.0826
07/23/2024	1.0851	1.0892	1.0898	1.0843
07/22/2024	1.0889	1.0881	1.0904	1.0872
07/19/2024	1.0877	1.0901	1.0903	1.0876
07/18/2024	1.0896	1.0938	1.0941	1.0893
07/17/2024	1.0937	1.0899	1.0948	1.0895
07/16/2024	1.0897	1.0895	1.0906	1.0871
07/15/2024	1.0894	1.0887	1.0923	1.0883
07/12/2024	1.0906	1.0866	1.0912	1.0861
07/11/2024	1.0865	1.0831	1.0901	1.0826
07/10/2024	1.0830	1.0813	1.0832	1.0811
07/09/2024	1.0812	1.0829	1.0834	1.0805
07/08/2024	1.0822	1.0809	1.0846	1.0802
07/05/2024	1.0836	1.0812	1.0843	1.0809
07/04/2024	1.0810	1.0786	1.0814	1.0783
07/03/2024	1.0786	1.0743	1.0818	1.0735
07/02/2024	1.0744	1.0741	1.0748	1.0709
07/01/2024	1.0738	1.0728	1.0777	1.0719
06/28/2024	1.0713	1.0703	1.0726	1.0684
06/27/2024	1.0702	1.0680	1.0727	1.0676
06/26/2024	1.0679	1.0713	1.0718	1.0666
06/25/2024	1.0713	1.0735	1.0745	1.0690
06/24/2024	1.0732	1.0688	1.0747	1.0683
06/21/2024	1.0691	1.0702	1.0721	1.0670
06/20/2024	1.0700	1.0745	1.0749	1.0702
06/19/2024	1.0742	1.0740	1.0754	1.0724
06/18/2024	1.0738	1.0734	1.0762	1.0709
06/17/2024	1.0734	1.0702	1.0739	1.0686
06/14/2024	1.0700	1.0737	1.0746	1.0668
06/13/2024	1.0735	1.0809	1.0817	1.0733

06/12/2024	1.0807	1.0742	1.0853	1.0734
06/11/2024	1.0739	1.0765	1.0775	1.0719
06/10/2024	1.0763	1.0797	1.0797	1.0732
06/07/2024	1.0800	1.0890	1.0903	1.0799
06/06/2024	1.0888	1.0869	1.0903	1.0862
06/05/2024	1.0868	1.0879	1.0892	1.0854
06/04/2024	1.0878	1.0904	1.0917	1.0859
06/03/2024	1.0902	1.0851	1.0905	1.0826
05/31/2024	1.0841	1.0832	1.0883	1.0811
05/30/2024	1.0832	1.0802	1.0846	1.0788
05/29/2024	1.0800	1.0857	1.0861	1.0799
05/28/2024	1.0855	1.0860	1.0890	1.0853
05/27/2024	1.0858	1.0854	1.0868	1.0841
05/24/2024	1.0845	1.0814	1.0859	1.0805
05/23/2024	1.0813	1.0824	1.0862	1.0805
05/22/2024	1.0821	1.0855	1.0864	1.0817
05/21/2024	1.0854	1.0859	1.0876	1.0842
05/20/2024	1.0855	1.0866	1.0885	1.0854
05/17/2024	1.0870	1.0866	1.0879	1.0835
05/16/2024	1.0865	1.0885	1.0896	1.0854
05/15/2024	1.0882	1.0819	1.0886	1.0812
05/14/2024	1.0818	1.0788	1.0826	1.0767
05/13/2024	1.0788	1.0774	1.0807	1.0766
05/10/2024	1.0769	1.0782	1.0790	1.0760
05/09/2024	1.0781	1.0751	1.0785	1.0724
05/08/2024	1.0745	1.0754	1.0758	1.0734
05/07/2024	1.0752	1.0770	1.0788	1.0747
05/06/2024	1.0768	1.0762	1.0791	1.0754
05/03/2024	1.0758	1.0727	1.0813	1.0724
05/02/2024	1.0725	1.0711	1.0731	1.0674

05/01/2024	1.0709	1.0664	1.0733	1.0649
04/30/2024	1.0665	1.0724	1.0736	1.0664
04/29/2024	1.0719	1.0695	1.0734	1.0690
04/26/2024	1.0692	1.0732	1.0754	1.0674
04/25/2024	1.0729	1.0699	1.0740	1.0678
04/24/2024	1.0697	1.0703	1.0715	1.0677
04/23/2024	1.0699	1.0655	1.0712	1.0638
04/22/2024	1.0654	1.0656	1.0671	1.0623
04/19/2024	1.0654	1.0645	1.0678	1.0610
04/18/2024	1.0643	1.0672	1.0690	1.0641
04/17/2024	1.0671	1.0619	1.0680	1.0605
04/16/2024	1.0617	1.0624	1.0654	1.0601
04/15/2024	1.0622	1.0637	1.0666	1.0619
04/12/2024	1.0642	1.0726	1.0731	1.0622
04/11/2024	1.0724	1.0743	1.0757	1.0698
04/10/2024	1.0742	1.0857	1.0868	1.0728
04/09/2024	1.0855	1.0859	1.0886	1.0847
04/08/2024	1.0858	1.0843	1.0863	1.0820
04/05/2024	1.0835	1.0836	1.0848	1.0791
04/04/2024	1.0835	1.0833	1.0877	1.0832
04/03/2024	1.0835	1.0772	1.0838	1.0763
04/02/2024	1.0768	1.0743	1.0780	1.0724
04/01/2024	1.0743	1.0788	1.0799	1.0731
03/29/2024	1.0793	1.0790	1.0806	1.0767
03/28/2024	1.0787	1.0827	1.0828	1.0774
03/27/2024	1.0826	1.0832	1.0840	1.0810
03/26/2024	1.0830	1.0838	1.0865	1.0824
03/25/2024	1.0836	1.0808	1.0843	1.0802
03/22/2024	1.0805	1.0860	1.0869	1.0802
03/21/2024	1.0860	1.0921	1.0943	1.0855

03/20/2024	1.0918	1.0864	1.0924	1.0836
03/19/2024	1.0865	1.0873	1.0877	1.0834
03/18/2024	1.0871	1.0893	1.0906	1.0865
03/15/2024	1.0887	1.0883	1.0900	1.0872
03/14/2024	1.0881	1.0950	1.0955	1.0880
03/13/2024	1.0946	1.0926	1.0964	1.0920
03/12/2024	1.0924	1.0925	1.0946	1.0899
03/11/2024	1.0926	1.0944	1.0948	1.0914
03/08/2024	1.0937	1.0948	1.0982	1.0919
03/07/2024	1.0946	1.0897	1.0950	1.0868
03/06/2024	1.0897	1.0859	1.0916	1.0841
03/05/2024	1.0855	1.0855	1.0877	1.0840
03/04/2024	1.0854	1.0842	1.0868	1.0838
03/01/2024	1.0837	1.0804	1.0844	1.0797
02/29/2024	1.0803	1.0836	1.0857	1.0795
02/28/2024	1.0836	1.0844	1.0848	1.0796
02/27/2024	1.0844	1.0850	1.0867	1.0832
02/26/2024	1.0847	1.0826	1.0861	1.0812
02/23/2024	1.0818	1.0824	1.0841	1.0812
02/22/2024	1.0823	1.0816	1.0889	1.0802
02/21/2024	1.0817	1.0807	1.0825	1.0790
02/20/2024	1.0803	1.0779	1.0840	1.0761
02/19/2024	1.0777	1.0776	1.0790	1.0761
02/16/2024	1.0774	1.0770	1.0788	1.0732
02/15/2024	1.0771	1.0727	1.0785	1.0725
02/14/2024	1.0725	1.0710	1.0735	1.0695
02/13/2024	1.0709	1.0772	1.0796	1.0700
02/12/2024	1.0771	1.0781	1.0806	1.0755
02/09/2024	1.0782	1.0779	1.0796	1.0761
02/08/2024	1.0776	1.0772	1.0790	1.0741

02/07/2024	1.0771	1.0755	1.0784	1.0753
02/06/2024	1.0754	1.0743	1.0763	1.0723
02/05/2024	1.0741	1.0784	1.0787	1.0723
02/02/2024	1.0784	1.0873	1.0898	1.0780
02/01/2024	1.0872	1.0814	1.0876	1.0779
01/31/2024	1.0816	1.0844	1.0889	1.0795
01/30/2024	1.0840	1.0833	1.0857	1.0811
01/29/2024	1.0833	1.0849	1.0850	1.0796
01/26/2024	1.0852	1.0843	1.0885	1.0812
01/25/2024	1.0846	1.0885	1.0903	1.0821
01/24/2024	1.0883	1.0854	1.0933	1.0845
01/23/2024	1.0851	1.0883	1.0917	1.0821
01/22/2024	1.0881	1.0891	1.0911	1.0879
01/19/2024	1.0897	1.0876	1.0898	1.0865
01/18/2024	1.0874	1.0882	1.0907	1.0846
01/17/2024	1.0881	1.0874	1.0885	1.0844
01/16/2024	1.0874	1.0950	1.0952	1.0862
01/15/2024	1.0948	1.0955	1.0969	1.0933
01/12/2024	1.0949	1.0974	1.0987	1.0935
01/11/2024	1.0970	1.0973	1.0991	1.0929
01/10/2024	1.0971	1.0931	1.0974	1.0922
01/09/2024	1.0931	1.0952	1.0967	1.0910
01/08/2024	1.0949	1.0946	1.0979	1.0922
jumlah	184.2567	184.2698	184.7540	183.7863

$x1^2$	$x2^2$	$x3^2$	$x4^2$	y^2
1.243894090	1.250818560	1.234987690	1.242422330	1.220362090
1.245277446	1.251892454	1.236855380	1.243983316	1.226999290

1.242779040	1.251310704	1.236588480	1.245322084	1.236544000
1.239392358	1.248582760	1.233076994	1.242912820	1.250818560
1.232100000	1.243403406	1.227398094	1.239525956	1.245679210
1.225847552	1.235832422	1.221422832	1.232322010	1.252161000
1.219743536	1.229215690	1.214888928	1.226068998	1.234765440
1.213742890	1.223678440	1.209824006	1.219964430	1.243225000
1.207009850	1.217888816	1.202882498	1.213875098	1.238769000
1.202224532	1.211452436	1.198017812	1.207097742	1.228772250
1.199901160	1.207141690	1.195348622	1.202180674	1.216167840
1.195960960	1.204067290	1.192420320	1.199857344	1.203628410
1.193162982	1.199156404	1.188972160	1.195873474	1.212641440
1.194080708	1.197623810	1.188536040	1.193162982	1.208240640
1.194386694	1.200602318	1.187707632	1.194080708	1.194867610
1.188710478	1.200383184	1.182177798	1.193731056	1.191590560
1.184527490	1.195567296	1.177572226	1.188187202	1.192027240
1.179656654	1.191808890	1.173105610	1.184005134	1.192682410
1.173928910	1.186269506	1.168517760	1.179005072	1.194649000
1.171416582	1.180264960	1.164672640	1.173235586	1.199463040
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1.1842003800	1.1906079000	1.1922892720	1.1872451560	1.1889702000
1.1869007696	1.1859582100	1.1880008300	1.1828942800	1.1844805700
1.1891678160	1.1877219760	1.1895700460	1.1846128700	1.1863304880
1.1912842592	1.1908853820	1.1931063300	1.1873797680	1.1891652360
1.1924396320	1.1890756800	1.1923399800	1.1864642400	1.1899243980
1.1896447320	1.1947121160	1.1984118640	1.1918223720	1.1959599600
1.1868545208	1.1907815440	1.1944957040	1.1881379360	1.1920487280
1.1836318536	1.1887706520	1.1929662360	1.1866947120	1.1906936280
1.1788054304	1.1868176180	1.1911486700	1.1852208160	1.1897049860
1.1741221224	1.1864588320	1.1900929040	1.1845980120	1.1875534320
1.1718264840	1.1808207140	1.1832834360	1.1783144040	1.1809078900
1.1714152368	1.1761609600	1.1785056400	1.1735991800	1.1761175400
1.1707005376	1.1757052800	1.1782451160	1.1729266560	1.1758572360
1.1706147824	1.1742973200	1.1763346760	1.1714146780	1.1736037520
1.1711988288	1.1701809600	1.1733354360	1.1678907240	1.1703538080
1.1706580608	1.1729536560	1.1764211760	1.1713282560	1.1735171280
1.1682350064	1.1722797760	1.1767041280	1.1706531760	1.1734943040

1.1656212752	1.1715193880	1.1754893900	1.1698706440	1.1723003720
1.1629443696	1.1672189280	1.1711999520	1.1650120560	1.1682141840
1.1601629592	1.1658319140	1.1694900880	1.1638837740	1.1676285320
1.1561379600	1.1630871080	1.1668946920	1.1611833160	1.1649909000
1.1528081712	1.1614305300	1.1644337640	1.1583624780	1.1614521360
1.1525505000	1.1587430400	1.1619761400	1.1554452780	1.1585275000
1.1533456352	1.1586144120	1.1618250640	1.1557485280	1.1583773840
1.1537969904	1.1592611880	1.1616092660	1.1557713840	1.1581625460
1.1560325560	1.1552755500	1.1576994000	1.1520795000	1.1542030500
1.1574947928	1.1529309400	1.1552655020	1.1508533940	1.1534449720
1.1561610496	1.1596704860	1.1615446400	1.1568269420	1.1594766080
1.1566130880	1.1628818280	1.1649304080	1.1584180800	1.1607038640
1.1594955504	1.1631398880	1.1661356160	1.1585924160	1.1621269440
1.1613698400	1.1645174360	1.1678564460	1.1589596000	1.1625571140
1.1651232256	1.1646151840	1.1680349560	1.1590231040	1.1625719240
1.1686873380	1.1646036660	1.1679763400	1.1591902020	1.1631428900
1.1708490036	1.1686189440	1.1723717760	1.1645210240	1.1692659840
1.1711978180	1.1796989760	1.1825256960	1.1749370400	1.1782421280
1.1737310360	1.1738388480	1.1773864960	1.1699667200	1.1736225280
1.1741860700	1.1775275200	1.1812998400	1.1727796000	1.1764652000
1.1770278856	1.1776770960	1.1818586340	1.1738205480	1.1767454580
1.1791554792	1.1804588560	1.1842136480	1.1770296240	1.1797860320
1.1803067264	1.1797411120	1.1836456720	1.1769211520	1.1797411120
1.1802415680	1.1842009960	1.1866387880	1.1809143300	1.1837221440
1.1816329888	1.1821730460	1.1839092060	1.1783317920	1.1807407140
1.1842647600	1.1868341940	1.1884445820	1.1827647000	1.1854631880
1.1869219680	1.1907151900	1.1921318000	1.1860294800	1.1883396440
1.1908251464	1.1901810480	1.1914424320	1.1853312440	1.1879192560
1.1944942688	1.1921876460	1.1941462260	1.1877917220	1.1906425440
1.1967902804	1.1914641800	1.1937042240	1.1880714920	1.1911162120

1.1965711440	1.1993752960	1.2020466080	1.1959157280	1.1992439200
1.1951039832	1.1988936020	1.2024191800	1.1947329820	1.1991782760
1.1942082300	1.2000521800	1.2043304800	1.1967173000	1.2008859000
1.1924611100	1.2004248780	1.2042647280	1.1961681300	1.1998982700
1.1934226572	1.1980594620	1.2016011060	1.1924190660	1.1958732620
1.1979939888	1.2021783020	1.2050907360	1.1968789860	1.1999228080
199.1110679228	199.6831988840	200.2148711720	199.1590628240	199.6766258960

Eliminasi Gauss

$$\begin{bmatrix} 170.000000 & 184.218940 & 184.708880 & 183.734760 & 184.211620 \\ 184.218940 & 199.643259 & 200.174308 & 199.118512 & 199.635565 \\ 184.708880 & 200.174308 & 200.706921 & 199.648227 & 200.166776 \\ 183.734760 & 199.118512 & 199.648227 & 198.595359 & 199.111068 \\ 184.211620 & 199.635565 & 200.166776 & 199.111068 & 199.628259 \end{bmatrix} \begin{bmatrix} 184.256700 \\ 199.683199 \\ 200.214871 \\ 199.159063 \\ 199.676626 \end{bmatrix}$$

Persamaan Multiple Linier Regression

$$170\alpha + 184.218940\beta_1 + 184.708880\beta_2 + 183.734760\beta_3 + 184.211620\beta_4 = 184.256700$$

$$184.218940\alpha + 199.643259\beta_1 + 200.174308\beta_2 + 199.118512\beta_3 + 199.635565\beta_4 = 199.683199$$

$$184.708880\alpha + 200.174308\beta_1 + 200.706921\beta_2 + 199.648227\beta_3 + 200.166776\beta_4 = 200.214871$$

$$183.734760\alpha + 199.118512\beta_1 + 199.648227\beta_2 + 198.595359\beta_3 + 199.111068\beta_4 = 199.159063$$

$$184.211620\alpha + 199.635565\beta_1 + 200.166776\beta_2 + 199.111068\beta_3 + 199.628259\beta_4 = 199.676626$$

Eliminasi kolom 1

$$r_2 = r_2 - (1.083641 \cdot r_1), r_3 = r_3 - (1.086523 \cdot r_1),$$

$$r_4 = r_4 - (1.080793 \cdot r_1), r_5 = r_5 - (1.083598 \cdot r_1)$$

$$\begin{bmatrix} 170.000000 & 184.218940 & 184.708880 & 183.734760 & 184.211620 \\ 0 & 0.016095 & 0.016225 & 0.016026 & 0.016334 \\ 0 & 0.016225 & 0.016507 & 0.016217 & 0.016646 \\ 0 & 0.016026 & 0.016217 & 0.016171 & 0.016493 \\ 0 & 0.016334 & 0.016646 & 0.016493 & 0.016959 \end{bmatrix} \begin{bmatrix} 184.256700 \\ 0.015117 \\ 0.015761 \\ 0.015765 \\ 0.016478 \end{bmatrix}$$

Eliminasi kolom 2

$$r_3 = r_3 - (1.008111 \cdot r_2), r_4 = r_4 - (0.995707 \cdot r_2), r_5 = r_5 - (1.014844 \cdot r_2)$$

$$\begin{bmatrix} 170.000000 & 184.218940 & 184.708880 & 183.734760 & 184.211620 \\ 0 & 0.016095 & 0.016225 & 0.016026 & 0.016334 \\ 0 & 0 & 0.000150 & 0.000061 & 0.000180 \\ 0 & 0 & 0.000061 & 0.000214 & 0.000229 \\ 0 & 0 & 0.000180 & 0.000229 & 0.000383 \end{bmatrix} \begin{bmatrix} 184.256700 \\ 0.015117 \\ 0.000522 \\ 0.000714 \\ 0.001136 \end{bmatrix}$$

Eliminasi kolom 3

$$r_4 = r_4 - (0.405348 \cdot r_3), r_5 = r_5 - (1.195747 \cdot r_3)$$

$$\begin{bmatrix} 170.000000 & 184.218940 & 184.708880 & 183.734760 & 184.211620 \\ 0 & 0.016095 & 0.016225 & 0.016026 & 0.016334 \\ 0 & 0 & 0.000150 & 0.000061 & 0.000180 \\ 0 & 0 & 0 & 0.000189 & 0.000156 \\ 0 & 0 & 0 & 0.000156 & 0.000168 \end{bmatrix} \begin{bmatrix} 184.256700 \\ 0.015117 \\ 0.000522 \\ 0.000502 \\ 0.000512 \end{bmatrix}$$

Eliminasi kolom 4

$$r_5 = r_5 - (0.825025 \cdot r_4)$$

$$\begin{bmatrix} 170.000000 & 184.218940 & 184.708880 & 183.734760 & 184.211620 \\ 0 & 0.016095 & 0.016225 & 0.016026 & 0.016334 \\ 0 & 0 & 0.000150 & 0.000061 & 0.000180 \\ 0 & 0 & 0 & 0.000189 & 0.000156 \\ 0 & 0 & 0 & 0 & 0.000039 \end{bmatrix} \begin{bmatrix} 184.256700 \\ 0.015117 \\ 0.000522 \\ 0.000502 \\ 0.000098 \end{bmatrix}$$

Ubah pivot = 1

$$r1 = r1/170, r2 = r2/ 0.016095, r3 = r3/ 0.000150, r4 = r4/ 0.000189, r5 = r5/ 0.000039$$

$$\begin{bmatrix} 1 & 1.083641 & 1.086523 & 1.080793 & 1.083598 \\ 0 & 1 & 1.008111 & 0.995707 & 1.014844 \\ 0 & 0 & 1 & 0.405348 & 1.195747 \\ 0 & 0 & 0 & 1 & 0.825025 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1.083863 \\ 0.939225 \\ 3.470535 \\ 2.653681 \\ 2.492010 \end{bmatrix}$$

Persamaan

$$\alpha + 1.083641\beta_1 + 1.086523\beta_2 + 1.080793\beta_3 + 1.083598\beta_4 = 1.083863$$

$$\beta_1 + 1.008111\beta_2 + 0.995707\beta_3 + 1.014844\beta_4 = 0.939225$$

$$\beta_2 + 0.405348\beta_3 + 1.195747\beta_4 = 3.470535$$

$$\beta_3 + 0.825025\beta_4 = 2.653681$$

$$\beta_4 = 2.492010$$

$$\beta_4 = 2.492010$$

- **Cari β_3**

$$\beta_3 = 0.825025(\beta_4) = 2.653681$$

$$\beta_3 = 2.653681 - (0.825025 * 2.492010)$$

$$\beta_3 = 0.597711$$

- **Cari β_2**

$$\beta_2 = 0.405348\beta_3 + 1.195747\beta_4 = 3.470535$$

$$\beta_2 = (0.405348 * 0.597711) + (1.195747 * 2.492010) = 3.470535$$

$$\beta_2 = 3.470535 - (0.405348 * 0.597711) - (1.195747 * 2.492010)$$

$$\beta_2 = 0.248441$$

- **Cari β_1**

$$\beta_1 = 1.008111\beta_2 + 0.995707\beta_3 + 1.014844\beta_4 = 0.939225$$

$$\begin{aligned}\beta_1 &= (1.008111 * 0.248441) + (0.995707 * 0.597711) + (1.014844 * 2.492010) \\ &= 0.939225\end{aligned}$$

$$\begin{aligned}\beta_1 &= 0.939225 - (1.008111 * 0.248441) - (0.995707 * 0.597711) \\ &\quad - (1.014844 * 2.492010)\end{aligned}$$

$$\beta_1 = -2.435378$$

- **Cari α**

$$\alpha = 1.083641\beta_1 + 1.086523\beta_2 + 1.080793\beta_3 + 1.083598\beta_4 = 1.083863$$

$$\begin{aligned}\alpha &= (1.083641 * -2.435378) + (1.086523 * 0.248441) + (1.080793 * 0.597711) + \\ &\quad (1.083598 * 0.597711) = 1.083863\end{aligned}$$

$$\begin{aligned}\alpha &= 1.083863 - (1.083641 * -2.435378) - (1.086523 * 0.248441) - \\ &\quad (1.080793 * 0.597711) - (1.083598 * 0.597711)\end{aligned}$$

$$\alpha = 0.106662$$

persamaan y

$$y = 0.106662 + (-2.435378)x_1 + 0.248441x_2 + 0.597711x_3 + 2.492010x_4$$

ypred	y- ypred	y-ymean	(y-ypred)^2
1.110272609	-0.005572609	0.020837	0.00003105397113335120
1.111128411	-0.003428411	0.023837	0.00001175400341700230
1.11521492	-0.00321492	0.028137	0.00001033571326617210
1.114977842	0.003422158	0.034537	0.00001171116828904800
1.117071501	-0.000971501	0.032237	0.00000094381389458389
1.113406633	0.005593367	0.035137	0.00003128575529261530
1.110591227	0.000608773	0.027337	0.00000037060470617667
1.108341667	0.006658333	0.031137	0.00004433339246719390
1.106376292	0.006623708	0.029137	0.00004387351082195290
1.101957657	0.006542343	0.024637	0.00004280225420360890
1.097740902	0.005059098	0.018937	0.00002559447129939820
1.098334301	-0.001234301	0.013237	0.00000152349798348134
1.095415234	0.005784766	0.017337	0.00003346351976486700
1.091008832	0.008191168	0.015337	0.00006709524091068100
1.091825272	0.001274728	0.009237	0.00000162493086254608
1.096215502	-0.004615502	0.007737	0.00002130285553336890
1.092748003	-0.000948003	0.007937	0.00000089870902155761
1.091759985	0.000340015	0.008237	0.00000011561007420364
1.090559571	0.002440429	0.009137	0.00000595569522288786
1.085006238	0.010193762	0.011337	0.00010391277559729200
1.080056458	0.010743542	0.006937	0.00011542369998675500
1.082794688	-0.003694688	-0.004763	0.00001365072155980020
1.082017904	0.000482096	-0.001363	0.00000023241626314774
1.081206908	0.000293092	-0.002363	0.00000008590309019073
1.084861475	-0.002961475	-0.001963	0.00000877033523006036
1.083815409	0.001884591	0.001837	0.00000355168271487500
1.082775525	0.001624475	0.000537	0.00000263892026867060
1.086690372	-0.002790372	3.71E-05	0.00000778617566374135
1.089211368	-0.004111368	0.001237	0.00001690334424122010

1.089394227	-0.000494227	0.005037	0.00000024426073336085
1.092409764	-0.004709764	0.003837	0.00002218187432571320
1.09507674	-0.00547674	0.005737	0.00002999467730298590
1.092352149	0.001347851	0.009837	0.00000181670140875659
1.090183697	-0.000483697	0.005837	0.00000023396231975551
1.0890435	0.0003565	0.005537	0.00000012709257813403
1.087220425	0.003379575	0.006737	0.00001142152851534320
1.085724735	0.000775265	0.002637	0.00000060103655981275
1.08596321	-0.00296321	-0.000863	0.00000878061055561588
1.085285416	-0.004085416	-0.002663	0.00001669062500787600
1.083709101	-0.001509101	-0.001663	0.00000227738709704477
1.080812249	0.002787751	-0.000263	0.00000777155334687185
1.078881118	0.002118882	-0.002863	0.00000448965913014460
1.07368772	0.00491228	-0.005263	0.00002413049884027990
1.072192882	0.002207118	-0.009463	0.00000487137099174771
1.073262726	0.000537274	-0.010063	0.00000028866337834034
1.072022746	-0.000722746	-0.012563	0.00000052236138216305
1.069177198	0.001022802	-0.013663	0.00000104612349994076
1.07187425	-0.00397425	-0.015963	0.00001579466180086320
1.073480563	-0.002180563	-0.012563	0.00000475485391784120
1.07289445	0.00030555	-0.010663	0.00000009336106780670
1.071738559	-0.002638559	-0.014763	0.00000696199376399158
1.071074143	-0.001074143	-0.013863	0.00000115378410302440
1.074827797	-0.000627797	-0.009663	0.00000039412893593582
1.07355184	0.00024816	-0.010063	0.00000006158346928893
1.071208074	0.002191926	-0.010463	0.00000480453929977273
1.071085947	-0.001085947	-0.013863	0.00000117928091062040
1.077758459	-0.004258459	-0.010363	0.00001813447232815290
1.075754068	0.004945932	-0.003163	0.00002446224561697740
1.07829067	-0.00439067	-0.009963	0.00001927798576831220

1.084248581	-0.007948581	-0.007563	0.00006317993484807800
1.089161142	-0.009161142	-0.003863	0.00008392651588838360
1.088465661	0.000334339	0.004937	0.00000011178270466174
1.085336577	0.001463423	0.002937	0.00000214160650415943
1.086127501	0.001672499	0.003937	0.00000279725190018583
1.083783877	0.006416123	0.006337	0.00004116663796260690
1.084668997	-0.000568997	0.000237	0.00000032375706322102
1.082933189	0.000266811	-0.000663	0.00000007118791694924
1.084307331	-0.004307331	-0.003863	0.00001855310324383970
1.084105139	0.001394861	0.001637	0.00000194563788962115
1.083611002	0.002188998	0.001937	0.00000479171080904497
1.082782218	0.001717782	0.000637	0.00000295077547896302
1.083157445	-0.001857445	-0.002563	0.00000345010094451851
1.088000712	-0.005900712	-0.001763	0.00003481840329159730
1.088519693	-0.003119693	0.001537	0.00000973248508613110
1.088221955	-0.002721955	0.001637	0.00000740903634254782
1.085940736	0.001059264	0.003137	0.00000112203934874741
1.086175383	0.000324617	0.002637	0.00000010537615472188
1.080944827	0.007255173	0.004337	0.00005263752830816450
1.07810421	0.00369579	-0.002063	0.00001365886208014040
1.077468945	0.001331055	-0.005063	0.00000177170757559388
1.079283549	-0.002383549	-0.006963	0.00000568130452478634
1.077574772	0.000525228	-0.005763	0.00000027586461726722
1.079023875	-0.004523875	-0.009363	0.00002046544064469590
1.075677745	-0.000477745	-0.008663	0.00000022824000233464
1.075450688	0.001349312	-0.007063	0.00000182064399474697
1.071026825	0.004773175	-0.008063	0.00002278320286762310
1.071903212	0.000596788	-0.011363	0.00000035615546495096
1.069650815	0.001249185	-0.012963	0.00000156046326147992
1.074276142	-0.007776142	-0.017363	0.00006046837926820090

1.071822154	7.78458E-05	-0.011963	0.00000000605997299612
1.073023083	-0.003823083	-0.014663	0.00001461596263640440
1.069361182	0.003538818	-0.010963	0.00001252323421173760
1.071122158	-0.001422158	-0.014163	0.00000202253338910775
1.067814697	0.002085303	-0.013963	0.00000434848674777615
1.067072593	-0.001672593	-0.018463	0.00000279756851335275
1.062935997	0.002464003	-0.018463	0.00000607131044893413
1.064529119	-0.000229119	-0.019563	0.00000005249559569615
1.058879884	0.008220116	-0.016763	0.00006757031347871140
1.063389083	-0.001689083	-0.022163	0.00000285300148169404
1.068499272	-0.006299272	-0.021663	0.00003968083149983380
1.075362217	-0.011162217	-0.019663	0.00012459509267025100
1.078708925	-0.006308925	-0.011463	0.00003980253114554380
1.087753539	-0.013553539	-0.009663	0.00018369843012972600
1.087070453	-0.001570453	0.001637	0.00000246632306162044
1.082635814	0.003164186	0.001937	0.00001001207079389650
1.082287481	0.001212519	-0.000363	0.00000147020141024918
1.07925058	0.00424942	-0.000363	0.00001805757363580630
1.076451351	0.007048649	-0.000363	0.00004968345502659100
1.076531998	0.000268002	-0.007063	0.00000007182497609666
1.081260364	-0.006960364	-0.009563	0.00004844667206979540
1.079180352	0.000119648	-0.004563	0.00000001431576200213
1.079779883	-0.001079883	-0.005163	0.00000116614702945780
1.083534731	-0.000934731	-0.001263	0.00000087372147741140
1.083753542	-0.000753542	-0.000863	0.00000056782500049790
1.082423959	0.001176041	-0.000263	0.00000138307342150691
1.086381411	-0.005881411	-0.003363	0.00003459099517743600
1.086374018	-0.000374018	0.002137	0.00000013988927570277
1.085952583	0.005847417	0.007937	0.00003419228632459300
1.087480235	-0.000980235	0.002637	0.00000096086153641487

1.088531809	-0.001431809	0.003237	0.00000205007704490703
1.08882712	-0.00012712	0.004837	0.00000001615949811056
1.094479939	-0.006379939	0.004237	0.00004070362128100820
1.094118288	0.000481712	0.010737	0.00000023204663784632
1.093040695	-0.000640695	0.008537	0.00000041048949554952
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1.087509351	0.007090649	0.010737	0.00005027730549290900
1.084323892	0.005376108	0.005837	0.00002890253946952240
1.083873865	0.001626135	0.001637	0.00000264431405227135
1.083958713	0.001441287	0.001537	0.00000207730792564291
1.082202005	0.001497995	-0.000163	0.00000224398885464691
1.084415642	-0.004115642	-0.003563	0.00001693850889460110
1.085084849	-0.001484849	-0.000263	0.00000220477766123102
1.085516729	-0.001116729	0.000537	0.00000124708374843723
1.083500841	0.001199159	0.000837	0.00000143798306860442
1.082718394	-0.000918394	-0.002063	0.00000084344762789529
1.083024443	-0.000724443	-0.001563	0.00000052481786854646
1.081580932	0.000119068	-0.002163	0.00000001417724722385
1.076289069	0.004010931	-0.003563	0.00001608756399005700
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1.073315296	0.004884704	-0.005663	0.00002386033762774710
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1.075867457	0.001232543	-0.006763	0.00000151916136700717
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1.085062379	-0.006662379	-0.005463	0.00004438729927555090
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1.084785538	-0.001485538	-0.000563	0.00000220682344795701
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1.090301105	-0.002201105	0.004237	0.00000484486452824351
1.093692917	-0.006292917	0.003537	0.00003960080561510780
1.094099317	0.000700683	0.010937	0.00000049095672027810
1.094370026	0.000529974	0.011037	0.00000028087277610532
1.095300335	0.001699665	0.013137	0.00000288886112968233
1.091825457	0.005274543	0.013237	0.00002782080713319640
1.08886906	0.00423094	0.009237	0.00001790085351331630
1.09053617	0.00436383	0.011037	0.00001904301593792030
			0.00262556083770022000

$(y - y_{\text{mean}})^2$	$(y - y_{\text{pred}})/y$	$\text{abs}((y - y_{\text{pred}})/y)$	$\text{abs}((y - y_{\text{pred}})/y) * 100$
0.0004341830204152	-0.0050444546084584	0.0050444546084584	0.5044454608458420
0.0005682053733564	-0.0030950719588832	0.0030950719588832	0.3095071958883230
0.0007916940792388	-0.0028911154799107	0.0028911154799107	0.2891115479910680
0.0011928084321800	0.0030598698367979	0.0030598698367979	0.3059869836797900
0.0010392279615917	-0.0008704424750599	0.0008704424750599	0.0870442475059938
0.0012346129027682	0.0049985407328760	0.0049985407328760	0.4998540732876040

0.0007473147851211	0.0005478519758075	0.0005478519758075	0.0547851975807528
0.0009695164321799	0.0059715987076876	0.0059715987076876	0.5971598707687590
0.0008489681968858	0.0059512203396093	0.0059512203396093	0.5951220339609340
0.0006069846674741	0.0059019785058980	0.0059019785058980	0.5901978505897950
0.0003586121968858	0.0045875026061551	0.0045875026061551	0.4587502606155140
0.0001752197262976	-0.0011250575198169	0.0011250575198169	0.1125057519816860
0.0003005736086505	0.0052531476395355	0.0052531476395355	0.5253147639535490
0.0002352253733564	0.0074519363813797	0.0074519363813797	0.7451936381379700
0.0000853232557093	0.0011661584120110	0.0011661584120110	0.1166158412011010
0.0000598620792388	-0.0042281986585348	0.0042281986585348	0.4228198658534820
0.0000629969027682	-0.0008682933215764	0.0008682933215764	0.0868293321576432
0.0000678491380623	0.0003113403668919	0.0003113403668919	0.0311340366891859
0.0000834858439446	0.0022327807055667	0.0022327807055667	0.2232780705566680
0.0001285289027682	0.0093076712946906	0.0093076712946906	0.9307671294690640
0.0000481227851211	0.0098492319818254	0.0098492319818254	0.9849231981825370
0.0000226856086505	-0.0034238608932790	0.0034238608932790	0.3423860893278990
0.0000018576086505	0.0004453539946043	0.0004453539946043	0.0445353994604282
0.0000055834910035	0.0002710053532547	0.0002710053532547	0.0271005353254733
0.0000038531380623	-0.0027372910417094	0.0027372910417094	0.2737291041709370
0.0000033747851211	0.0017358302122140	0.0017358302122140	0.1735830212213960
0.0000002884321799	0.0014980407438207	0.0014980407438207	0.1498040743820670
0.0000000013733564	-0.0025743813617077	0.0025743813617077	0.2574381361707680
0.0000015303145329	-0.0037889297622292	0.0037889297622292	0.3788929762229170
0.0000253719615917	-0.0004538776844266	0.0004538776844266	0.0453877684426619
0.0000147230204152	-0.0043300208907951	0.0043300208907951	0.4330020890795140
0.0000329138439446	-0.0050263763399052	0.0050263763399052	0.5026376339905150
0.0000967677262976	0.0012323769430663	0.0012323769430663	0.1232376943066340
0.0000340712557093	-0.0004438804406447	0.0004438804406447	0.0443880440644699
0.0000306590204152	0.0003272447771395	0.0003272447771395	0.0327244777139468
0.0000453879615917	0.0030988219305596	0.0030988219305596	0.3098821930559640

0.0000069540792388	0.0007135439272804	0.0007135439272804	0.0713543927280386
0.0000007446674740	-0.0027361121906600	0.0027361121906600	0.2736112190659970
0.0000070912557093	-0.0037785942808352	0.0037785942808352	0.3778594280835160
0.0000027653733564	-0.0013944755316921	0.0013944755316921	0.1394475531692080
0.0000000691380623	0.0025726749622297	0.0025726749622297	0.2572674962229700
0.0000081964321799	0.0019601124655872	0.0019601124655872	0.1960112465587150
0.0000276985498270	0.0045543115255013	0.0045543115255013	0.4554311525501280
0.0000895472557093	0.0020542798352977	0.0020542798352977	0.2054279835297680
0.0001012627851211	0.0005003483194011	0.0005003483194011	0.0500348319401050
0.0001578274910035	-0.0006746436333585	0.0006746436333585	0.0674643633358532
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0.0002548154910035	-0.0037215561768645	0.0037215561768645	0.3721556176864490
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0.0002179444321799	-0.0024680189240883	0.0024680189240883	0.2468018924088310
0.0001921811380623	-0.0010038723622291	0.0010038723622291	0.1003872362229120
0.0000933724321799	-0.0005844320337653	0.0005844320337653	0.0584432033765330
0.0001012627851211	0.0002311046457616	0.0002311046457616	0.0231104645761630
0.0001094731380623	0.0020420401843822	0.0020420401843822	0.2042040184382170
0.0001921811380623	-0.0010149037485640	0.0010149037485640	0.1014903748563950
0.0001073905498270	-0.0039668923285476	0.0039668923285476	0.3966892328547640
0.0000100041968858	0.0045766005638152	0.0045766005638152	0.4576600563815170
0.0000992601968858	-0.0040885280842544	0.0040885280842544	0.4088528084254370
0.0000571980792388	-0.0073850977249459	0.0073850977249459	0.7385097724945910
0.0000149223145329	-0.0084825385424285	0.0084825385424285	0.8482538542428540
0.0000243745498270	0.0003070712766253	0.0003070712766253	0.0307071276625253
0.0000086263145329	0.0013465429450109	0.0013465429450109	0.1346542945010850
0.0000155004321799	0.0015375056992155	0.0015375056992155	0.1537505699215500
0.0000401583145329	0.0058852717679671	0.0058852717679671	0.5885271767967070
0.0000000561968858	-0.0005248561392911	0.0005248561392911	0.0524856139291111

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0.0000026799615917	0.0012849942366278	0.0012849942366278	0.1284994236627780
0.0000037521968858	0.0020160229068280	0.0020160229068280	0.2016022906827960
0.0000004058439446	0.0015839392711404	0.0015839392711404	0.1583939271140400
0.0000065686674740	-0.0017177885279320	0.0017177885279320	0.1717788527931980
0.0000031079615917	-0.0054530192222366	0.0054530192222366	0.5453019222236610
0.0000023625498270	-0.0028742335615294	0.0028742335615294	0.2874233561529400
0.0000026799615917	-0.0025075582752674	0.0025075582752674	0.2507558275267410
0.0000098411380623	0.0009744835215691	0.0009744835215691	0.0974483521569102
0.0000069540792388	0.0002987730652177	0.0002987730652177	0.0298773065217683
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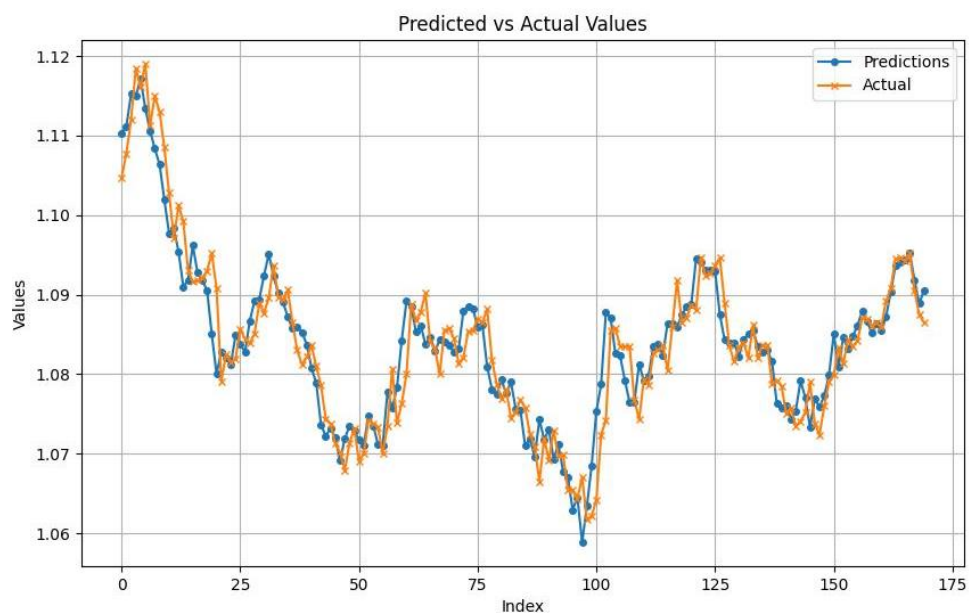
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0.0001196192557093	0.0006400100825569	0.0006400100825569	0.0640010082556934
0.0001218166674741	0.0004840390140270	0.0004840390140270	0.0484039014027018
0.0001725823145329	0.0015493755744171	0.0015493755744171	0.1549375574417060
0.0001752197262976	0.0048077142561221	0.0048077142561221	0.4807714256122110
0.0000853232557093	0.0038705882601292	0.0038705882601292	0.3870588260129160
0.0001218166674741	0.0039855972421134	0.0039855972421134	0.3985597242113350
0.0202119365294117			46.1214489376372000

y mean
1.08386294117647

Hasil perbandingan data actual dengan data prediksi



EVALUASI PERFORMA

Evaluasi ini digunakan untuk mengukur seberapa baik model regresi dapat memprediksi nilai yang diinginkan berdasarkan data yang ada.

Total Sum of Squares (TSS)

- **Definisi:** TSS mengukur total variasi dalam data dari nilai rata-rata variabel dependen. Ini mencakup semua variasi yang ada dalam data.

- **Rumus**

$$RSS = \sum (y_i - \hat{y}_i)^2$$

$$RSS = 0.00262556083770022$$

Di mana:

- y_i adalah nilai aktual.
- \hat{y}_i adalah rata-rata dari nilai aktual.

Fungsi: TSS digunakan sebagai ukuran total variabilitas dalam data. Ini memberikan dasar untuk membandingkan seberapa baik model regresi dapat menjelaskan variasi ini.

Residual Sum of Squares (RSS)

- **Definisi:** RSS mengukur jumlah kuadrat dari kesalahan (residual) antara nilai yang diprediksi oleh model dan nilai aktual. Ini mencerminkan variasi yang tidak dapat dijelaskan oleh model.

- **Rumus**

$$TSS = \sum (y_i - \bar{y}_i)^2$$

$$TSS = 0.02021193652941170000$$

Di mana:

- y_i adalah nilai aktual.

- \bar{y}_i adalah nilai yang diprediksi oleh model.

Fungsi: RSS menunjukkan seberapa baik model mendekati data aktual. Semakin kecil nilai RSS, semakin baik model dalam memprediksi nilai variabel dependen.

1. RSE

Definisi: RSE adalah ukuran standar deviasi dari residual (error) dalam model regresi. Ini menunjukkan seberapa jauh rata-rata observasi data aktual menyimpang dari garis regresi yang diprediksi oleh model.

Rumus:

$$RSE = \sqrt{\frac{RSS}{n-2}}$$

$$RSE = 0.003929946$$

Di mana:

- **RSS** adalah Residual Sum of Squares.
- **n** adalah jumlah observasi.

Interpretasi: Semakin kecil nilai RSE, semakin baik model memprediksi data. RSE yang besar menunjukkan banyak variabilitas yang tidak dijelaskan oleh model, menunjukkan kesalahan yang lebih besar dalam prediksi.

2. R SQUARE

Definisi: R^2 mengukur proporsi variasi dalam variabel dependen yang dapat dijelaskan oleh variabel independen dalam model. Ini adalah ukuran kebaikan dari model regresi.

Rumus

$$R^2 = 1 - \frac{RSS}{TSS}$$

$$R^2 = 0.870098501750211$$

Di mana:

- **RSS** adalah Residual Sum of Squares.
- **TSS** adalah Total Sum of Squares.

Interpretasi: Nilai R^2 berkisar antara 0 hingga 1. Nilai mendekati 1 menunjukkan bahwa model dapat menjelaskan sebagian besar variasi dalam data. R^2 sebesar 0,8, misalnya, berarti 80% dari variasi variabel dependen dijelaskan oleh model.

3. KOEFISIEN KORELASI R

Definisi: Koefisien korelasi R adalah akar dari R^2 dan mengukur kekuatan serta arah hubungan linear antara variabel independen dan dependen.

Rumus:

$$R = \sqrt{R^2}$$

$$R = 0.9327907063$$

Interpretasi: Koefisien korelasi R berkisar antara -1 hingga 1:

- $R=1$: Hubungan linear positif sempurna.
- $R=-1$: Hubungan linear negatif sempurna.
- $R=0$: Tidak ada hubungan linear.

4. ADJUSTED R SQUARE

Definisi: Adjusted R^2 adalah versi R^2 yang disesuaikan untuk memperhitungkan jumlah variabel independen dalam model. Ini membantu menghindari bias karena penambahan variabel yang tidak relevan.

Rumus:

$$R_{adj}^2 = 1 - \left(\frac{RSS}{TSS} \right) \left(\frac{n-1}{n-p-1} \right)$$

$$R_{adj}^2 = 0.866949375$$

Di mana:

- **n** adalah jumlah observasi.
- **k** adalah jumlah variabel independen.

Interpretasi: Adjusted R^2 berguna untuk membandingkan model dengan jumlah variabel independen yang berbeda. Nilai yang lebih tinggi menunjukkan model yang lebih baik, tetapi Adjusted R^2 tidak akan meningkat jika variabel independen yang ditambahkan tidak relevan.

5. MEAN SQUARE ERROR

Definisi: MSE mengukur rata-rata dari kuadrat kesalahan antara nilai aktual dan nilai prediksi. MSE digunakan untuk menilai seberapa besar kesalahan prediksi yang dilakukan model.

Rumus:

$$MSE = \frac{RSS}{n}$$

$$MSE = 0.0000154444755158837$$

Dimana :

- n adalah banyak data

Interpretasi: Semakin kecil nilai MSE, semakin baik model dalam memprediksi nilai variabel dependen. MSE yang tinggi menunjukkan banyak kesalahan dalam prediksi.

6. ROOT MEAN SQUARE ERROR

Definisi: RMSE adalah akar kuadrat dari MSE. RMSE mengukur seberapa besar rata-rata kesalahan prediksi dalam satuan yang sama dengan variabel dependen.

Rumus:

$$RMSE = \sqrt{\frac{RSS}{n}}$$

$$RMSE = 0.003929946$$

Interpretasi: RMSE memberikan gambaran seberapa jauh prediksi model berada dari nilai aktual dalam skala aslinya. Nilai yang lebih rendah menunjukkan kesalahan prediksi yang lebih kecil.

7. MEAN ABSOLUTE PERCENTAGE ERROR

Definisi: MAPE mengukur kesalahan prediksi dalam persentase. MAPE memberikan informasi tentang tingkat kesalahan relatif terhadap nilai aktual, dinyatakan sebagai persentase.

Rumus:

$$MAPE = \frac{\sum \frac{|y_i - \hat{y}_i|}{y_i} 100\%}{n}$$

$$MAPE = 0.271302641$$

- **Interpretasi:** MAPE berguna untuk mengukur kesalahan dalam konteks proporsional. Semakin kecil nilai MAPE, semakin baik model dalam hal akurasi prediksi. Misalnya, MAPE sebesar 5% berarti rata-rata kesalahan prediksi adalah 5% dari nilai aktual.

KESIMPULAN

Berdasarkan hasil dari 7 evaluasi performa, rata-rata harga penutupan 5 hari sebelumnya, rata-rata harga pembukaan 5 hari sebelumnya, rata-rata harga tertinggi 5 hari sebelumnya, dan rata-rata harga terendah 5 hari sebelumnya dapat digunakan untuk memprediksi harga penutupan harian EUR/USD. Hal ini dibuktikan dengan hasil $R0.9327907063$, $R^2=0.870098501750211$, dan $RMSE = 0.003929946$. Keempat elemen tersebut dipilih karena memiliki hubungan yang signifikan dengan harga penutupan harian, di mana prediksi tersebut menunjukkan tingkat kesalahan yang rendah.

Sebagai langkah pengembangan lebih lanjut, penambahan variabel seperti data makroekonomi, seperti Non-Farm Payroll (NFP), Consumer Price Index (CPI), dan pernyataan Federal Open Market Committee (FOMC) dapat dipertimbangkan untuk meningkatkan akurasi prediksi harga penutupan EUR/USD.

Selain itu, pemilihan harga penutupan hari ini sebagai variabel dependen dianggap penting karena mencerminkan konsensus pasar dan keputusan akhir trader serta investor. Harga penutupan juga mencakup reaksi terhadap berita dan informasi sepanjang hari, sehingga memberikan gambaran yang lebih baik tentang sentimen pasar pada saat itu.

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