

BAB VI

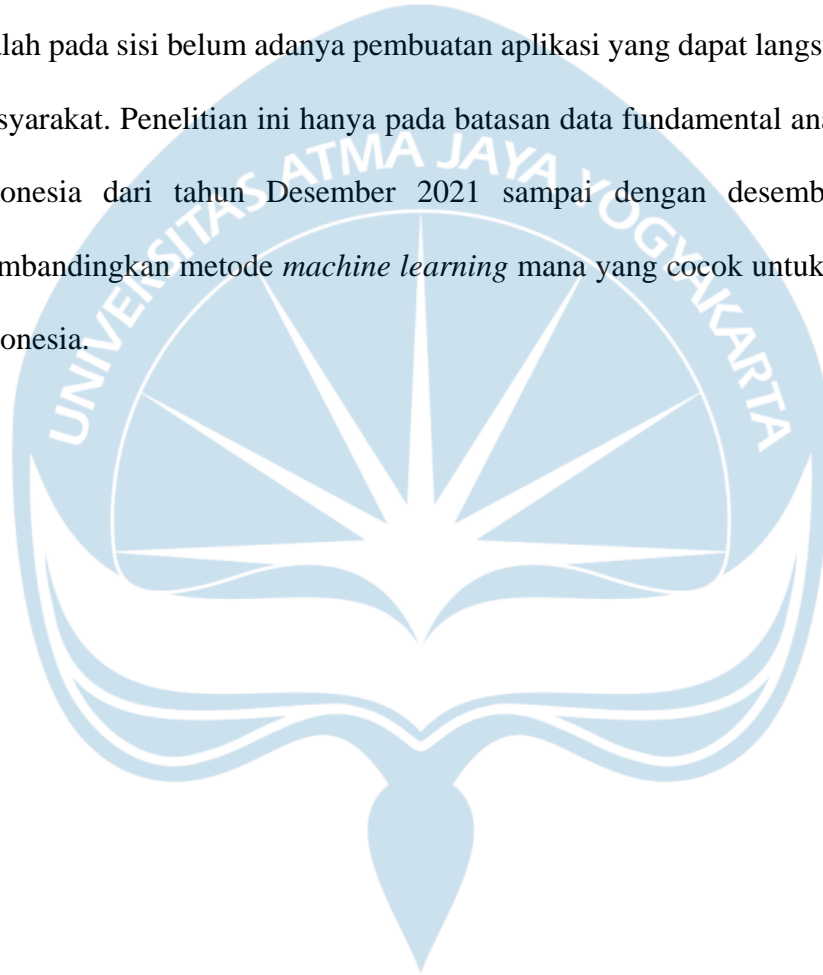
KESIMPULAN DAN SARAN

6.1 Kesimpulan

Penelitian ini dilakukan untuk menerapkan *decision tree*, *SVM*, *naive bayes* yang diaplikasikan pada data analisis fundamental saham sektor finansial di Indonesia. Analisis Fundamental yang dipilih adalah ROA, PBV, PER, ROE, *Debt to equity ratio*, dan EPS. Didalam proses penerapan *machine learning* dilakukan adalah pemberian label data berdasarkan nilai analisis fundamental, penyesuaian data menggunakan *standart scaling*, dan yang terakhir adalah penggunaan *machine learning* untuk klasifikasi data menjadi tiga kategori (beli, pantau, jangan beli). Di bab pembahasan dapat dilihat semua proses tersebut, lalu hasilnya adalah pada metode *decision tree* mendapatkan nilai akurasi rata-rata 91.7%, metode SVM mendapat nilai akurasi rata-rata 75.7%, dan metode *naive bayes* mendapatkan nilai akurasi rata-rata 50%. Dari hasil diatas dapat disimpulkan bahwa *machine learning* dapat diterapkan pada data analisis fundamental saham sektor finansial yang ada di Indonesia dan dapat diterapkan. Dilihat dari waktu pelatihan dan waktu prediksi, metode *decision tree* juga menghasilkan waktu tercepat. Dengan hasil percobaan diatas, metode *decision tree* adalah metode yang paling cocok untuk data saham di Indonesia dan dapat menjadikan salah satu pertimbangan dalam menentukan saham untuk diinvestasikan.

6.2 Saran

Penelitian ini masih memiliki beberapa keterbatasan dari beberapa sisi dan dapat dikembangkan di penelitian selanjutnya. Keterbatasan dalam penelitian ini adalah pada sisi belum adanya pembuatan aplikasi yang dapat langsung digunakan masyarakat. Penelitian ini hanya pada batasan data fundamental analisis saham di Indonesia dari tahun Desember 2021 sampai dengan desember 2022, dan membandingkan metode *machine learning* mana yang cocok untuk data saham di Indonesia.



ARTI LAMBANG DAN SINGKATAN

LAMBANG DAN SINGKATAN	ARTI
ROA	Return on Asset
COVID-19	Coronavirus Disease 2019
PBV	Price to Book
ROE	Return on Equity
PER	Price earning ratio
DER	Debt to equity ratio
EPS	Earnings Per Share
$P(C_i X)$	Posterior propabilitas (posterior)
$P(C_i)$	Kemungkinan apriori (apriori propabilitas)
$P(X C_i)$	Kemungkinan
$P(X)$	Probabilitas prediktor kelas sebelumnya
TP	True positif
TN	True negatif
FP	False positif
FN	Flase negatif
w	vektor bobot
x	vektor fitur input
b	bias
IDX	Bursa efek Indonesia

References

- [1] M. Topcu and O. S. Gulal, "The impact of *COVID-19* on emerging stock markets," *Financ. Res. Lett.*, vol. 36, p. 101691, 2020, doi: 10.1016/j.frl.2020.101691.
- [2] A. Fernandez-Perez, A. Gilbert, I. Indriawan, and N. H. Nguyen, "*COVID-19* pandemic and stock market response: A culture effect," *J. Behav. Exp. Financ.*, vol. 29, p. 100454, 2021, doi: 10.1016/j.jbef.2020.100454.
- [3] B. G. Malkiel, "Efficient Market Hypothesis," *Finance*, pp. 127–134, 1989, doi: 10.1007/978-1-349-20213-3_13.
- [4] D. Zhang, M. Hu, and Q. Ji, "Financial markets under the global pandemic of *COVID-19*," *Financ. Res. Lett.*, vol. 36, no. March, p. 101528, 2020, doi: 10.1016/j.frl.2020.101528.
- [5] A. M. Al-Awadhi, K. Alsaifi, A. Al-Awadhi, and S. Alhammadi, "Death and contagious infectious diseases: Impact of the *COVID-19* virus on stock market returns," *J. Behav. Exp. Financ.*, vol. 27, p. 100326, 2020, doi: 10.1016/j.jbef.2020.100326.
- [6] M. V. Achim, I. L. Safta, V. L. Văidean, G. M. Mureșan, and N. S. Borlea, "The impact of *COVID-19* on financial management: evidence from Romania," *Econ. Res. Istraz.*, vol. 35, no. 1, pp. 1807–1832, 2022, doi: 10.1080/1331677X.2021.1922090.
- [7] R. K. Mule, M. S. Mukras, and N. O. Mutunga, "Corporate size, profitability and market value: an econometric panel analysis of listed firms in Kenya," *Eur. Sci. J.*, vol. 11, no. 13, pp. 376–396, 2015.
- [8] M. Kamran *et al.*, "Munich Personal RePEc Archive Determinants of financial performance of financial sectors (An assessment through economic value added) Determinants of Financial Performance of Financial Sectors (An Assessment through Economic Value Added) Arshad Ullah Jado," no. 81281, 2017.
- [9] I. K. Nti, A. F. Adekoya, and B. A. Weyori, *A systematic review of fundamental and technical analysis of stock market predictions*, vol. 53, no. 4. Springer Netherlands, 2020.
- [10] S. Sutrisno, B. Panuntun, and F. I. Adristi, "The Effect of *COVID-19* Pandemic on the Performance of Islamic Bank in Indonesia," *Equity*, vol. 23, no. 2, pp. 125–136, 2020, doi: 10.34209/equ.v23i2.2245.
- [11] S. Devi, N. M. S. Warasniasih, and P. R. Masdiantini, "The Impact of *COVID-19* Pandemic on the Financial Performance of Firms on the Indonesia Stock Exchange," *J. Econ. Business, Account. Ventur.*, vol. 23, no. 2, 2020, doi: 10.14414/jebav.v23i2.2313.
- [12] C. T. Sari, M. Suharti, S. Semarang, and I. Surakarta, "The Effect Of Taxes, Earnings Per Share, And Sales Growth On Stock Prices In The *COVID-19* Pandemic (Empirical Study Of Health And Pharmaceutical Sector Listed In The Jakarta Stock Exchange 2016-2020)," *Bus. Account. Res. Peer Rev. J.*, vol. 5, no. 2, pp. 530–540,

- 2021, [Online]. Available: <https://jurnal.stie-aas.ac.id/index.php/IJEBAR>.
- [13] T. J. Strader, J. J. Rozycki, T. H. Root, and Y.-H. (John) Huang, “Machine learning Stock Market Prediction Studies : Review and Research Directions,” *J. Int. Technol. Inf. Manag.*, vol. 28, no. 4, pp. 63–83, 2020, [Online]. Available: <https://scholarworks.lib.csusb.edu/jitim/vol28/iss4/3>.
- [14] A. Namdari and Z. S. Li, “Integrating Fundamental and Technical Analysis of Stock Market through Multi-layer Perceptron,” *2018 IEEE Technol. Eng. Manag. Conf. TEMSCON 2018*, pp. 2–7, 2018, doi: 10.1109/TEMSCON.2018.8488440.
- [15] S. M. Bartram and M. Grinblatt, “Agnostic fundamental analysis works,” *J. financ. econ.*, vol. 128, no. 1, pp. 125–147, 2018, doi: 10.1016/j.jfineco.2016.11.008.
- [16] E. F. Fama and K. R. French, “A five-factor asset pricing model,” *J. financ. econ.*, vol. 116, no. 1, pp. 1–22, 2015, doi: 10.1016/j.jfineco.2014.10.010.
- [17] Z. Haider Khan, T. Sharmin Alin, and A. Hussain, “Price Prediction of Share Market Using Artificial Neural Network ‘ANN,’” *Int. J. Comput. Appl.*, vol. 22, no. 2, pp. 42–47, 2011, doi: 10.5120/2552-3497.
- [18] E. Endri, “Determinants of Firm Value: A Case Study of Cigarette Companies Listed on the Indonesia Stock Exchange,” *SSRN Electron. J.*, vol. 6, no. 8, pp. 51–59, 2020, doi: 10.2139/ssrn.3649042.
- [19] M. N. Elagamy, C. Stanier, and B. Sharp, “Stock market *random forest*-text mining system mining critical indicators of stock market movements,” *2nd Int. Conf. Nat. Lang. Speech Process. ICNLSP 2018*, pp. 1–8, 2018, doi: 10.1109/ICNLSP.2018.8374370.
- [20] M. Studies and E. Journal, “Klasifikasi Keputusan Investasi Di Masa Pandemi COVID-19 Dengan Menggunakan *Naive bayes*,” vol. 3, no. July, pp. 1784–1796, 2022.
- [21] G. A. A. Jabbar Alkubaisi, S. S. Kamaruddin, and H. Husni, “Stock Market Classification Model Using Sentiment Analysis on Twitter Based on Hybrid *Naive bayes* Classifiers,” *Comput. Inf. Sci.*, vol. 11, no. 1, p. 52, 2018, doi: 10.5539/cis.v11n1p52.
- [22] M. Studies and E. Journal, “Klasifikasi Keputusan Investasi Di Masa Pandemi COVID-19 Dengan Menggunakan *Naive bayes*,” *Manag. Stud. Entrep. J.*, vol. 3, no. August, pp. 1784–1796, 2022.
- [23] C. Kosol and P. Sachakamol, “Stock Performance Classification in Stock Exchange of Thailand (SET) by Using Supervised *Machine learning* Model,” *Int. J. Mach. Learn. Comput.*, vol. 10, no. 2, pp. 213–219, 2020, doi: 10.18178/ijmlc.2020.10.2.922.
- [24] Y. A. Babalola and F. R. Abiola, “Financial Ratio Analysis of Firms: A Tool for Decision Making Related papers Financial Ratio Analysis of Firms: A Tool for Decision Making,” *Int. J. Manag. Sci. IJMS Int. J. Manag. Sci. Int. J. Manag. Sci.*, vol. 1, no. 4, pp. 132–137, 2013, [Online]. Available: <http://www.rassweb.com>.

- [25] P. C. Sen, M. Hajra, and M. Ghosh, *in Machine learning : A Survey and Review*. Springer Singapore, 2020.
- [26] F. Sukesti, I. Ghozali, F. Fuad, A. K. Almasyhari, and N. Nurcahyono, “Factors Affecting the Stock Price: The Role of Firm Performance,” *J. Asian Financ. Econ. Bus.*, vol. 8, no. 2, pp. 165–173, 2021, doi: 10.13106/jafeb.2021.vol8.no2.0165.
- [27] A. Indra Lekso Wibowo Putra, A. Dwiansyah Putra, M. Sari Dewi, and D. Oktavina Radianto, “Differences In Intrinsic Value With Stock Market Prices Using The Price Earning Ratio (Per) Approach As An Investment Decision Making Indicator,” *Aptisi Trans. Technopreneursh.*, vol. 1, no. 1, pp. 94–105, 2019.
- [28] M. Arce and A. Mora, “Empirical evidence of the effect of European accounting differences on the stock market valuation of earnings and book value,” *Eur. Account. Rev.*, vol. 11, no. 3, pp. 573–599, 2002, doi: 10.1080/09638180220125616.
- [29] T. Sharif, H. Purohit, and R. Pillai, “Analysis of Factors Affecting Share Prices: The Case of Bahrain Stock Exchange,” *Int. J. Econ. Financ.*, vol. 7, no. 3, 2015, doi: 10.5539/ijef.v7n3p207.
- [30] M. R. Utami and A. Darmawan, “Effect of DER, ROA, ROE, EPS and MVA on Stock Prices in Sharia Indonesian Stock Index,” *J. Appl. Account. Tax.*, vol. 4, no. 1, pp. 15–22, 2019, doi: 10.30871/jaat.v4i1.1195.
- [31] S. Borovkova and I. Tsiamas, “An ensemble of LSTM neural networks for high-frequency stock market classification,” *J. Forecast.*, vol. 38, no. 6, pp. 600–619, 2019, doi: 10.1002/for.2585.
- [32] K. Pahwa and N. Agarwal, “Stock Market Analysis using Supervised *Machine learning*,” *Proc. Int. Conf. Mach. Learn. Big Data, Cloud Parallel Comput. Trends, Perspectives Prospect. Com. 2019*, pp. 197–200, 2019, doi: 10.1109/COMITCon.2019.8862225.
- [33] A. Picasso, S. Merello, Y. Ma, L. Oneto, and E. Cambria, “Technical analysis and sentiment embeddings for market trend prediction,” *Expert Syst. Appl.*, vol. 135, pp. 60–70, 2019, doi: 10.1016/j.eswa.2019.06.014.
- [34] Marianto dkk, “Implementasi Naïve Bayes Classifier Dan Confusion Matrix Pada Analisis Sentimen,” *J. Gaussian*, vol. Volume 9, pp. 16–25, 2020.
- [35] J. Bruzda, “Real and complex wavelets in asset classification: An application to the US stock market,” *Financ. Res. Lett.*, vol. 21, pp. 115–125, 2017, doi: 10.1016/j.frl.2017.02.004.
- [36] O. Bustos and A. Pomares-Quimbaya, “Stock market movement forecast: A Systematic review,” *Expert Syst. Appl.*, vol. 156, 2020, doi: 10.1016/j.eswa.2020.113464.
- [37] K. Valiant, Y. Lukito, and R. G. Santosa, “Sistem Prediksi Harga Saham LQ45 Dengan *Random forest* Classifier,” *J. Terap. Teknol. Inf.*, vol. 3, no. 2, pp. 127–136, 2019, doi: 10.21460/jutei.2019.32.187.

- [38] M. Mazur, M. Dang, and M. Vega, "COVID-19 and the march 2020 stock market crash. Evidence from S&P1500," *Financ. Res. Lett.*, vol. 38, no. July 2020, p. 101690, 2021, doi: 10.1016/j.frl.2020.101690.
- [39] B. N. Ashraf, "Stock markets' reaction to COVID-19: Cases or fatalities?," *Res. Int. Bus. Financ.*, vol. 54, no. May, p. 101249, 2020, doi: 10.1016/j.ribaf.2020.101249.
- [40] C. F. Tsai and Y. C. Hsiao, "Combining multiple feature selection methods for stock prediction: Union, intersection, and multi-intersection approaches," *Decis. Support Syst.*, vol. 50, no. 1, pp. 258–269, 2010, doi: 10.1016/j.dss.2010.08.028.
- [41] D. Septyanto and N. Firgrita Welandasari, "Ratio , and Return on Assets on Financial Distress in INDONESIA STOCK EXCHANGE," *Septyanto, Dihin Firgrita Welandasari, Nadia*, 2018.
- [42] A. Ullah, C. Pinglu, S. Ullah, M. Zaman, and S. H. Hashmi, "The nexus between capital structure, firm-specific factors, macroeconomic factors and financial performance in the textile sector of Pakistan," *Heliyon*, vol. 6, no. 8, p. e04741, 2020, doi: 10.1016/j.heliyon.2020.e04741.
- [43] Maenuddina, R. Bansal, A. Hussain, M. Hafeez, M. Khan, and N. Wahi, "Economic value Added momentum & Traditional Profitability Measures (RoA, Roe & Roce): A comparative study," *Test Eng. Manag.*, vol. 83, no. April, 2020.
- [44] K. Fatema, "Fundamental Analysis of Dhaka Stock Exchange (DSE) Listed Top Five NBFIs: A Study on Bangladesh," *J. Int. Bus. Manag.*, no. June, pp. 0–20, 2022, doi: 10.37227/jibm-2022-04-5396.
- [45] S. Ray, "A Quick Review of Machine learning Algorithms," *Proc. Int. Conf. Mach. Learn. Big Data, Cloud Parallel Comput. Trends, Prespectives Prospect. Com. 2019*, pp. 35–39, 2019, doi: 10.1109/COMITCon.2019.8862451.
- [46] H. H. Patel and P. Prajapati, "Study and Analysis of Decision tree Based Classification Algorithms," *Int. J. Comput. Sci. Eng.*, vol. 6, no. 10, pp. 74–78, 2018, doi: 10.26438/ijcse/v6i10.7478.
- [47] D. Marutho, "Perbandingan Metode Naive bayes , KNN , Decision tree Pada Laporan Water Level Jakarta," *Manaj. Inform. AMIK JTC Semarang*, vol. 15, no. 2, pp. 90–97, 2019.
- [48] C. N. Kamath, S. S. Bukhari, and A. Dengel, "Comparative study between traditional machine learning and deep learning approaches for text classification," *Proc. ACM Symp. Doc. Eng. 2018, DocEng 2018*, 2018, doi: 10.1145/3209280.3209526.
- [49] S. Huang, C. A. I. Nianguang, P. Penzuti Pacheco, S. Narandes, Y. Wang, and X. U. Wayne, "Applications of support vector machine (SVM) learning in cancer genomics," *Cancer Genomics and Proteomics*, vol. 15, no. 1, pp. 41–51, 2018, doi: 10.21873/cgp.20063.
- [50] L. Nilawati and Y. E. Achyani, "Optimasi Metode Particle Swarm Optimization (PSO) Pada Prediksi Penilaian Apartemen," *Paradig. - J. Komput. dan Inform.*, vol.

21, no. 2, pp. 227–234, 2019, doi: 10.31294/p.v21i2.6159.

- [51] S. Ruuska, W. Hämäläinen, S. Kajava, M. Mughal, P. Matilainen, and J. Mononen, “Evaluation of the confusion matrix method in the validation of an automated system for measuring feeding behaviour of cattle,” *Behav. Processes*, vol. 148, pp. 56–62, 2018, doi: 10.1016/j.beproc.2018.01.004.

