PREDIKSI PENDERITA DIARE DENGAN METODE *SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* (SARIMA) DI KOTA BANDUNG

SKRIPSI

Diajukan untuk Memenuhi Bagian dari
Syarat Memperoleh Gelar Sarjana Komputer
Pada Departemen Pendidikan Ilmu Komputer

oleh
Cacuk Jati Pangestu
NIM 1600583

PROGRAM STUDI ILMU KOMPUTER
DEPARTEMEN PENDIDIKAN ILMU KOMPUTER
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS PENDIDIKAN INDONESIA
BANDUNG
2020

PREDIKSI PENDERITA DIARE DENGAN METODE *SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* (SARIMA) DI KOTA BANDUNG

Oleh

Cacuk Jati Pangestu

NIM 1600583

Sebuah Skripsi yang Diajukan untuk Memenuhi Salah Satu Syarat Memperoleh Gelar Sarjana Komputer di Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

Universitas Pendidikan Indonesia

Juni 2020

CACUK JATI PANGESTU

1600583

PREDIKSI PENDERITA DIARE DENGAN METODE *SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* (SARIMA) DI KOTA BANDUNG

DISETUJUI DAN DISAHKAN OLEH PEMBIMBING:

Pembimbing I,

Prof. Dr. Munir, M.IT.

NIP. 196603252001121001

Pembimbing II,

Erna Piantari, M.T.

NIP. 920171219890224201

Mengetahui,

Ketua Departemen Pendidikan Ilmu Komputer

Lala Septem Riza, M.T., Ph.D.

NIP. 197809262008121001

PREDIKSI PENDERITA DIARE DENGAN METODE *SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE* (SARIMA) DI KOTA BANDUNG

Oleh

Cacuk Jati Pangestu — cacukjati@student.upi.edu

1600583

ABSTRAK

Abstrak— Diare merupakan penyakit kedua yang menyebabkan kematian pada anak-anak di dunia. Setiap tahunnya, sekitar 1,7 juta kasus diare ditemukan dan menyebabkan sekitar 525.000 kematian pada anak di bawah usia lima tahun di dunia. Analisis yang tepat dari data layanan kesehatan dapat membantu memprediksi epidemi, penyembuhan, dan penyakit, serta meningkatkan kualitas hidup dan menghindari kematian yang dapat dicegah. Penelitian ini ditujukan untuk memprediksi penderita diare di masa yang akan datang dengan menggunakan *Seasonal Autoregressive Integrated Moving Average* (SARIMA) dan *Seasonal Autoregressive Integrated Moving Average with explanatory X* (SARIMAX) dengan melibatkan faktor cuaca berupa temperatur rata-rata dan kelembapan rata-rata. Data yang digunakan adalah data jumlah penderita diare dan data cuaca pada tahun 2010-2019 di Kota Bandung. Pada hasil penelitian, diperoleh bahwa temperatur dan kelembapan memiliki pengaruh yang tidak signifikan terhadap jumlah terjadinya kasus diare di Kota Bandung dan model SARIMA memiliki hasil yang lebih baik daripada model SARIMAX dengan penambahan faktor cuaca. Akurasi prediksi dari model SARIMA yang di dapat adalah 78,6%.

Kata Kunci: *Diare, Time Series, SARIMA, SARIMAX*

PREDIKSI PENDERITA DIARE DENGAN METODE SEASONAL **AUTOREGRESSIVE INTEGRATED MOVING AVERAGE** *(SARIMA) DI KOTA BANDUNG*

Arranged by

Cacuk Jati Pangestu — cacukjati@student.upi.edu

1600583

ABSTRACT

Abstact – Diarrhea is the second disease that causes death in children in the world. Every year, around 1.7 million cases of diarrhea are found and cause around 525,000 deaths in children under the age of five in the world. Proper analysis of health service data can help predict epidemics, cure, and disease, and improve quality of life and avoid preventable deaths. This research is aimed at predicting diarrhea sufferers in the future by using Seasonal Autoregressive Integrated Moving Average (SARIMA) and Seasonal Autoregressive Integrated Moving Average with explanatory X (SARIMAX) by involving climate factors in the form of average temperature and average humidity. The data used are data of diarrhea sufferers and climate in 2010-2019 in the city of Bandung. The result shows that there is not significant relation between temperature or humidity and the diarrhea cases in Bandung and the SARIMA model had better results than the SARIMAX model with the addition of climate factors. The predictive accuracy of the SARIMA model obtained is 78.6%.

Keywords: Diarrhea, Time Series, SARIMA, SARIMAX

DAFTAR ISI

DAFTAR PUSTAKA

Amin, L. Z. (2015). Tata Laksana Diare Akut. *Continuing Medical Education*. https://doi.org/10.1080/09595238280000261

Anggraeni, W., Vinarti, R. A., & Kurniawati, Y. D. (2015). Performance Comparisons between Arima and Arimax Method in Moslem Kids Clothes Demand Forecasting: Case Study. *Procedia Computer Science*, *72*, 630–637. https://doi.org/10.1016/j.procs.2015.12.172

As'ad, M., Wibowo, S. S., & Sophia, E. (2017). Peramalan Jumlah Mahasiswa Baru Dengan Model Autoregressive Integrated Moving Average (Arima). *Jurnal Informatika Merdeka Pasuruan*, *2*(3), 20–33.

Bandyopadhyay, S., Kanji, S., & Wang, L. (2012). The impact of rainfall and temperature variation on diarrheal prevalence in Sub-Saharan Africa. *Applied Geography*. https://doi.org/10.1016/j.apgeog.2011.07.017

Carlton, E. J., Woster, A. P., DeWitt, P., Goldstein, R. S., & Levy, K. (2016). A systematic review and meta-analysis of ambient temperature and diarrhoeal diseases. *International Journal of Epidemiology*, *45*(1), 117–130. https://doi.org/10.1093/ije/dyv296

Chou, W. C., Wu, J. L., Wang, Y. C., Huang, H., Sung, F. C., & Chuang, C. Y. (2010). Modeling the impact of climate variability on diarrhea-associated diseases in Taiwan (1996-2007). *Science of the Total Environment*. https://doi.org/10.1016/j.scitotenv.2010.09.001

Chowdhury, F. R., Ibrahim, Q. S. U., Shafiqul Bari, M., Jahangir Alam, M. M., Dunachie, S. J., Rodriguez-Morales, A. J., & Ismail Patwary, M. (2018). The association between temperature, rainfall and humidity with common climate-sensitive infectious diseases in Bangladesh. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0199579

Da Veiga, C. P., Da Veiga, C. R. P., Catapan, A., Tortato, U., & Da Silva, W. V. (2014). Demand forecasting in food retail: A comparison between the Holt-Winters and ARIMA models. *WSEAS*

Transactions on Business and Economics, *11*(1), 608–614.

Dewi, C., Kartikasari, D. P., & Mursityo, Y. T. (2014). Prediksi Cuaca Pada Data Time Series Menggunakan Adaptive Neuro Fuzzy Inference System (Anfis). *Jurnal Teknologi Informasi Dan Ilmu Komputer (JTIIK)*.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series With a Unit Root. *Journal of the American Statistical Association*. https://doi.org/10.2307/2286348

Dürre, A., Fried, R., & Liboschik, T. (2015). Robust estimation of (partial) autocorrelation. *Wiley Interdisciplinary Reviews: Computational Statistics*, *7*(3), 205–222. https://doi.org/10.1002/wics.1351

Ediger, V. Ş., & Akar, S. (2007). ARIMA forecasting of primary energy demand by fuel in Turkey. *Energy Policy*, *35*(3), 1701–1708. https://doi.org/10.1016/j.enpol.2006.05.009

Emmanuel John, E. (2016). Short-Term Forecasting of Nigeria Inflation Rates Using Seasonal ARIMA Model. *Science Journal of Applied Mathematics and Statistics*, *4*(3), 101. https://doi.org/10.11648/j.sjams.20160403.13

Fathurahman, M. (2009). Pemilihan Model Regresi Terbaik Menggunakan Metode Akaike's Information Criterion dan Schwarz Information Criterion. *Jurnal Informatika Mulawarman*, *4*(3).

Freeman, M. C., Stocks, M. E., Cumming, O., Jeandron, A., Higgins, J. P. T., Wolf, J., … Curtis, V. (2014). Systematic review: Hygiene and health: Systematic review of handwashing practices worldwide and update of health effects. *Tropical Medicine and International Health*, *19*(8), 906–916. https://doi.org/10.1111/tmi.12339

Hashem, I. A. T., Chang, V., Anuar, N. B., Adewole, K., Yaqoob, I., Gani, A., … Chiroma, H. (2016). The role of big data in smart city. *International Journal of Information Management*, *36*(5), 748–758. https://doi.org/10.1016/j.ijinfomgt.2016.05.002

Hassani, H., & Yeganegi, M. R. (2020). Selecting optimal lag order in Ljung–Box test. *Physica A: Statistical Mechanics and Its Applications*, *541*, 123700.

https://doi.org/10.1016/j.physa.2019.123700

Howard, G., Calow, R., Macdonald, A., & Bartram, J. (2016). Climate Change and Water and Sanitation: Likely Impacts and Emerging Trends for Action. *Annual Review of Environment and Resources*, *41*(1), 253–276. https://doi.org/10.1146/annurev-environ-110615-085856

Kongcharoen, C., & Kruangpradit, T. (2013). Autoregressive Integrated Moving Average with Explanatory Variable (ARIMAX) Model for Thailand Export. *33rd International Symposium on Forecasting, South Korea*, (June), 1–8. Retrieved from http://www.researchgate.net/publication/255731345_Autoregressive_Integrated_Moving_Average_with_Explanatory_Variable_(ARIMAX)_Model_for_Thailand_Export/file/9c9605209ac48013f6.pdf

Kumar, S. V., & Vanajakshi, L. (2015). Short-term traffic flow prediction using seasonal ARIMA model with limited input data. *European Transport Research Review*. https://doi.org/10.1007/s12544-015-0170-8

Mellor, J. E., Levy, K., Zimmerman, J., Elliott, M., Bartram, J., Carlton, E., … Nelson, K. (2016). Planning for climate change: The need for mechanistic systems-based approaches to study climate change impacts on diarrheal diseases. *Science of the Total Environment*. https://doi.org/10.1016/j.scitotenv.2015.12.087

Milenković, M., Švadlenka, L., Melichar, V., Bojović, N., & Avramović, Z. (2018). SARIMA modelling approach for railway passenger flow forecasting. *Transport*, *33*(5), 1113–1120. https://doi.org/10.3846/16484142.2016.1139623

Mohamed Salleh, F. H., Arif, S. M., Zainudin, S., & Firdaus-Raih, M. (2015). Reconstructing gene regulatory networks from knock-out data using Gaussian Noise Model and Pearson Correlation Coefficient. *Computational Biology and Chemistry*, *59*, 3–14. https://doi.org/10.1016/j.compbiolchem.2015.04.012

Omane-adjepong, M., Oduro, F. T., & Oduro, S. D. (2013). Determining the

Better Approach for Short-Term Forecasting of Ghana's Inflation: Seasonal-ARIMA vs Holt-Winters. *International Journal of Business, Humanitiies and Technology*, *3*(1), 69–79.

Sharafi, M., Ghaem, H., Tabatabaee, H. R., & Faramarzi, H. (2017). Forecasting the number of zoonotic cutaneous leishmaniasis cases in south of Fars province, Iran using seasonal ARIMA time series method. *Asian Pacific Journal of Tropical Medicine*. https://doi.org/10.1016/j.apjtm.2016.12.007

Troeger, C., Blacker, B. F., Khalil, I. A., Rao, P. C., Cao, S., Zimsen, S. R., … Reiner, R. C. (2018). Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Infectious Diseases*. https://doi.org/10.1016/S1473-3099(18)30362-1

Vagropoulos, S. I., Chouliaras, G. I., Kardakos, E. G., Simoglou, C. K., & Bakirtzis, A. G. (2016). Comparison of SARIMAX, SARIMA, modified SARIMA and ANN-based models for short-term PV generation forecasting. *2016 IEEE International Energy Conference, ENERGYCON 2016*. https://doi.org/10.1109/ENERGYCON.2016.7514029

Victor-edema, U. A. (2016). Autoregressive Integrated Moving Average with Exogenous Variable (ARIMAX) Model for Nigerian Non Oil Export. *European Journal of Business and Management*, *8*(36), 2010–2015.

World Health Organization. (2017). Diarrhoeal disease. Di ambil dari https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease

Hutasuhut, A. H., Anggraeni, W., & Tyasnurita, R. (2014). Pembuatan Aplikasi Pendukung Keputusan untuk Peramalan Persediaan Bahan Baku Produksi Plastik Blowing dan Inject Menggunakan Metode ARIMA (Autoregressive Integrated Moving Average) di CV. Asia. *Jurnal Teknik ITS*, *3*(2), A169-A174.

Machmudin, A., & Ulama, B. S. (2012). Peramalan Temperatur Udara di Kota Surabaya dengan Menggunakan ARIMA dan Artificial Neural Network. *Jurnal Sains dan Seni ITS*, *1*(1), D118-D123.

Heizer, J., Render, B., & Munson, C. (2017). *Operations management*. Pearson Education Limited.

Kementerian Kesehatan RI. (2011). Pedoman Nasional Pengendalian Tuberkulosis. Direktorat Jendral Pengendalian Penyakit Dan Penyehatan Lingkungan. Jakarta.

Puspita, E. S., & Yulianti, L. (2016). Perancangan sistem peramalan cuaca berbasis logika fuzzy. Jurnal Media Infotama, 12(1).

Cryer, J. D., & Chan, K. S. (2008). *Time series analysis. With applications in R*. Springer.

Wei, W. W. (2006). Time series analysis. In *The Oxford Handbook of Quantitative Methods in Psychology: Vol. 2*.

Sommerville, I. (2016). Software engineering, tenth, global ed.

World Health Organization. (2005). The treatment of diarrhoea: a manual for physicians and other senior health workers (No. WHO/FCH/CAH/05.1). World Health Organization.