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A particle swarm optimization levy flight algorithm for imputation of missing creatinine dataset
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Abstract

Clinicians could intervene during what may be a crucial stage for preventing permanent kidney injury if patients with incipient Acute Kidney Injury (AKI) and those at high risk of developing AKI could be identified. This paper proposes an improved mechanism to machine learning imputation algorithms by introducing the Particle Swarm Levy Flight algorithm. We improve the algorithms by modifying the Particle Swarm Optimization Algorithm (PSO), by enhancing the algorithm with levy flight (PSOLF). The creatinine dataset that we collected, including AKI diagnosis and staging, mortality at hospital discharge, and renal recovery, are tested and compared with other machine learning algorithms such as Genetic Algorithm and traditional PSO. The proposed algorithms' performances are validated with a statistical significance test. The results show that SVMPSOLF has better performance than the other method. This research could be useful as an important tool of prognostic capabilities for determining which patients are likely to suffer from AKI, potentially allowing clinicians to intervene before kidney damage manifests. © 2021, Universitas Ahmad Dahlan. All rights reserved.

Author Keywords

Baseline creatinine; Imputation; Levy flight; Missing data; Particle swarm optimization

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References

- Kellum, J. a
KDIGO Clinical Practice Guideline for Acute Kidney Injury
(2012) *Kidney Int. Suppl*, 2 (1), pp. 1-138.
Google Scholar
- Wang, H. E., Jain, G., Glasscock, R. J., Warnock, D. G.
Comparison of absolute serum creatinine changes versus Kidney Disease: Improving Global Outcomes consensus definitions for characterizing stages of acute kidney injury
(2013) *Nephrol. Dial. Transplant*, pp. 1447-1454.
January
- Chertow, G. M., Burdick, E., Honour, M., Bonventre, J. V, Bates, D. W.
Acute Kidney Injury, Mortality, Length of Stay, and Costs in Hospitalized Patients
(2005) *J. Am. Soc. Nephrol*,
- Hamid, S. A., Adnan, W. W., Naing, N. N., Adnan, A. S.
Acute Kidney Injury in Intensive Care Unit, Hospital Universiti Sains Malaysia: A Descriptive Study
(2018) *Saudi J. Kidney Dis. Transplant*, 29 (5), pp. 1109-1114.
- Ostermann, M., Joannidis, M.
Acute kidney injury 2016: diagnosis and diagnostic workup
(2016) *Crit. Care*, 20 (299), pp. 1-13.

- Bernier-Jean, A.
Diagnosis and outcomes of acute kidney injury using surrogate and imputation methods for missing preadmission creatinine values
(2017) *BMC Nephrol*, 18 (1), pp. 1-9.
- Siew, E. D., Peterson, J. F., Eden, S. K., Moons, K. G., Ikizler, T. A., Matheny, M. E.
Use of Multiple Imputation Method to Improve Estimation of Missing Baseline Serum Creatinine in Acute Kidney Injury Research
(2013) *Clin. J. Am. Soc. Nephrol*, 8.
- Lai, W. Y., Kuok, K. K., Gato-trinidad, S., Ling, K. X.
A Study on Sequential K-Nearest Neighbor (SKNN) Imputation for Treating Missing Rainfall Data
(2019) *Int. J. Adv. Trends Comput. Sci. Eng*, 8 (3), pp. 363-368.
- Delaney, H. D., Vargha, A.
A Critique and Improvement of the CL Common Language Effect Size Statistics of McGraw and Wong
(2000) *J. Educ. Behav. Stat*, 25 (2), pp. 101-132.
- Zainal Abidin, N. Z., Ismail, A. R., Emran, N. A.
Performance Analysis of Machine Learning Algorithms for Missing Value Imputation
(2018) *Int. J. Adv. Comput. Sci. Appl*, 9 (6).
- Zhang, S.
Nearest neighbor selection for iteratively k NN imputation
(2012) *J. Syst. Softw*, 85 (11), pp. 2541-2552.
- Wang, G., Deng, Z., Choi, K.-S.
Tackling missing data in community health studies using additive LS-SVM classifier
(2016) *IEEE J. Biomed. Heal. Informatics*, 22 (2), pp. 1-1.
- Kennedy, J., Eberhart, R. C., Shi, Y.
(2001) *Swarm Intelligence. The Morgan Kaufmann Series in Artificial Intelligence*,
Google Books
- Lili-Li, Xingshi-He
Gaussian mutation Particle Swarm Optimization with dynamic adaptation inertia weight
(2009) *World Congr. Softw. Eng*, (1), pp. 454-459.
- Bashath, S., Ismail, A. R.
Comparison of Swarm Intelligence Algorithms for High Dimensional Optimization Problems
(2018) *Indones. J. Electr. Eng. Comput. Sci*, pp. 300-307.
July
- Cui, Q.
Globally-optimal Prediction-based Adaptive Mutation Particle Swarm Optimization
(2017) *Inf. Sci. (Ny)*,
- Abualigah, L. M., Khader, A. T., Hanandeh, E. S.
A new feature selection method to improve the document clustering using particle swarm optimization algorithm
(2017) *J. Comput. Sci*,
October
- Sangeetha, A. L., Bharathi, N., Ganesh, A. B., Radhakrishnan, T. K.
Particle Swarm Optimization Tuned Cascade Control System in an Internet of

Things (IoT) Environment
(2017) *Measurement*,

- Junior, D. S., Lima, M.
Particle Swarm Optimization for 3D object tracking in RGB-D images
(2018) *Comput. Graph*,
J. G., do, J. P. S., Google Scholar
- Dewang, H. S., Mohanty, P. K., Kundu, S.
A Robust Path Planning For Mobile Robot Using Smart Particle Swarm Optimization
(2018) *Procedia Comput. Sci*, 133, pp. 290-297.
- Sajid, A., Khan, A., Ishtiaq, M., Shaheen, M.
Face Recognition under varying Expressions and Illumination using particle swarm optimization
(2018) *J. Comput. Sci*,
Google Scholar
- Ibrahim, A. M., El-amary, N. H.
Particle Swarm Optimization trained recurrent neural network for voltage instability prediction
(2017) *J. Electr. Syst. Inf. Technol*,
- Zhao, D., Liu, J.
Study on network security situation awareness based on particle swarm optimization algorithm
(2018) *Comput. Ind. Eng*, 125.
- Pashaei, N., Pashaei, E., Aydin
Gene selection using hybrid binary black hole algorithm and modified binary particle swarm optimization
(2017) *Genomics*, 1 (1), pp. 33-57.
E Google Scholar
- Zheng, Z., Saxena, N., Mishra, K. K., Sangaiah, A. K.
Guided Dynamic Particle Swarm Optimization for Optimizing Digital Image Watermarking in Industry Applications
(2018) *Futur. Gener. Comput. Syst*,
- Bonyadi, M. R., Michalewicz, Z.
Particle Swarm Optimization for Single Objective Continuous Space Problems: A Review
(2016) *Evol. Comput*, (xx), pp. 1-54.
- Wang, D., Tan, D., Liu, L.
Particle swarm optimization algorithm: an overview
(2018) *Soft Comput*, 22 (2), pp. 387-408.
- Poli, R., Kennedy, J., Blackwell, T.
Particle swarm optimization An overview
(2007) *Swarm Intell*, pp. 33-57.
- Kennedy, J., Eberhart, R.
Particle Swarm Optimization
(1995) *IEEE Int. Conf*, 4, pp. 1942-1948.
- Jensi, R., Jiji, G. W.
An Enhanced Particle Swarm Optimization with Levy Flight for Global Optimization
(2016) *Appl. Soft Comput. J*,
- Hariya, Y., Kurihara, T., Shindo, T., Jin'No, K.

Lévy flight PSO

(2015) *2015 IEEE Congr. Evol. Comput. CEC 2015-Proc*, pp. 2678-2684.

May 2015

- Hakli, H., Uğuz, H.
A novel particle swarm optimization algorithm with Levy flight
(2014) *Appl. Soft Comput. J*, 23, pp. 333-345.
- Tholen, C., El-Mihoub, T. A., Nolle, L.
On a novel search strategy based on a combination of particle swarm optimisation and levy-flight
(2018) *Proc.-Eur. Counc. Model. Simulation, ECMS*, pp. 190-194.
- Jana, N. D., Sil, J.
Particle Swarm Optimization with Lévy Flight and Adaptive Polynomial Mutation in gbest Particle
(2014) *Recent Adv. Intell. Informatics*, pp. 275-276.
- Guan, T., Han, F., Han, H.
A Modified Multi-Objective Particle Swarm Optimization Based on Levy Flight and Double-Archive Mechanism
(2019) *IEEE Access*, 7, pp. 183444-183467.
- Chegini, S. N., Bagheri, A., Najafi, F.
PSOSCALF: A new hybrid PSO based on Sine Cosine Algorithm and Levy flight for solving optimization problems
(2018) *Appl. Soft Comput. J*, 73, pp. 697-726.

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