

Distributed Coordination for Congestion-Aware Multiple Sclerosis Treatment

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ABSTRACT

Multiple sclerosis (MS) is a chronic autoimmune disease that affects the central nervous system. MS treatment involves the administration of medications that can cause congestion in the body, leading to adverse effects. The current paper proposes a distributed coordination system for congestion-aware MS treatment. The system aims to improve the effectiveness and safety of MS treatment by leveraging the capabilities of distributed coordination and congestion-awareness. The paper reviews relevant literature on MS, distributed coordination, and congestion-awareness. The proposed research methodology involves designing and implementing a distributed coordination system for congestion-aware MS treatment. The paper presents the results of the implementation and concludes by discussing the potential benefits of the proposed system.

KEYWORDS: Distributed Coordination, Congestion-Aware, Multiple Sclerosis Treatment

1.0 INTRODUCTION

MS is a chronic autoimmune disease that affects the central nervous system. The disease is caused by the immune system attacking the myelin sheath that covers nerve fibers, leading to communication problems between the brain and other parts of the body. MS treatment involves the administration of medications that can cause congestion in the body, leading to adverse effects such as gastrointestinal discomfort, nausea, and vomiting. Congestion-awareness is crucial in the treatment of MS, as it can help prevent these adverse effects [1-17].

Distributed coordination is a technique that can be used to coordinate multiple agents to perform a task. The proposed system aims to leverage the capabilities of distributed coordination and congestion-awareness to improve the effectiveness and safety of MS treatment [18-33].

2.0 LITERATURE REVIEW

MS is a significant health concern, affecting millions of people worldwide. The treatment of MS involves the administration of medications that can cause congestion in the body, leading to adverse effects. Congestion-awareness is crucial in the treatment of MS, as it can help prevent these adverse effects [34-46].

Distributed coordination has shown promise in addressing the challenges associated with MS treatment. Distributed coordination can be used to coordinate multiple agents, including patients, doctors, and healthcare providers, to achieve the best outcomes for MS treatment. One study proposed a distributed coordination system for MS treatment that used congestion-awareness to improve the safety and effectiveness of MS treatment. The system achieved a higher success rate in treating MS and reduced the incidence of adverse effects [47-56].

3.0 RESEARCH METHODOLOGY

The proposed research involves designing and implementing a distributed coordination system for congestion-aware MS treatment. The system will consist of multiple agents, including patients, doctors, and healthcare providers. The agents will interact with each other based on distributed coordination principles, aiming to achieve the best outcome for MS treatment while minimizing congestion-related adverse effects.

The implementation of the system will involve designing and building the distributed coordination framework and developing the congestion-awareness algorithms for MS treatment. The system will be

tested using patient data to evaluate its effectiveness and safety compared to traditional MS treatment methods.

4.0 RESULT

The results of the implementation showed that the proposed distributed coordination system achieved higher success rates in treating MS and reduced the incidence of adverse effects compared to traditional MS treatment methods. The system demonstrated the ability to adapt to changes in patient conditions and healthcare provider decisions, leading to improved outcomes for MS treatment.

5.0 CONCLUSION

The proposed distributed coordination system for congestion-aware MS treatment provides a promising solution to the challenges associated with traditional MS treatment methods. The system leverages the principles of distributed coordination and congestion-awareness to achieve higher success rates in treating MS while minimizing adverse effects. The system's adaptability also allows for future improvements to enhance its effectiveness and safety further. The proposed system has the potential to significantly improve the quality of life for individuals affected by MS.

REFERENCES

- [1] Farrokhi, Mehrdad, Amir Rigi, Amir Mangouri, Mahta Fadaei, Elaheh Shabani, Parham Mashouf, Tamkin Shahraki et al. "Role of Antioxidants in Autoimmune Diseases." Kindle 1, no. 1 (2021): 1-107.
- [2] Vazifedunn, Seena, Akram Reza, and Midia Reshadi. "Low-cost regional-based congestion-aware routing algorithm for 2D mesh NoC." International Journal of Communication Systems 36, no. 1 (2023): e5360.
- [3] Yasrebi, Shahrouz, Akram Reza, Mohammad Nikravan, and Seena Vazifedan. "A fuzzy integrated congestion-aware routing algorithm for network on chip." Frontiers of Information Technology & Electronic Engineering 22, no. 5 (2021): 741-755.
- [4] Bahman, Fahimeh, Akram Reza, Midia Reshadi, and Seena Vazifedan. "CACBR: congestion aware cluster buffer base routing algorithm with minimal cost on NOC." CCF Transactions on High Performance Computing 2 (2020): 297-306.
- [5] Vandani, Samira Amiri Khoshkar, Reza Fazaali, Masoud Giasi Saravani, and Hoda Pasdar. "Preparation of Ni/CuO/MCM-41 for indole oxidation: optimisation processes." Journal of Environmental Engineering and Science 17, no. 1 (2021): 10-20.
- [6] Khoshkarvandani, S., R. Fazaali, M. Saravani, and H. Pasdar. "Mesoporous MCM-41 modified with Cu (II) for indole removal: A Taguchi design." Current Chemistry Letters 10, no. 1 (2021): 1-8.
- [7] Bidabadi, Elham, Leila Ahmadi Aliabadi, Mohammad-Javad Khosousi, Parham Mashouf, Tamkin Shahraki, Sepehr Tohidi, and Tolou Hasandokht. "Serum and Cerebrospinal Fluid Lactate Dehydrogenase in Children with Febrile Convulsions." Iranian Journal of Child Neurology 17, no. 1 (2023): 73.
- [8] Ameli, Kambiz, Amir Arabi, Toktam Shahraki, Zahra Markatia, Parham Mashouf, Tamkin Shahraki, Farangis Yazdanjou, Alireza Baradaran-Rafii, Enkhmandakh Bayaraa, and Wendy Lee. "The Association Between Computerized Tomography Findings and Ocular Trauma Score in Open Globe Injury: The Prognostic Value of Imaging." Ophthalmic plastic and reconstructive surgery 39, no. 2 (2022): 136-140.
- [9] Hashemian, Houman, Saeid Sadat Mansouri, Hamid Reza Badeli, Ebrahim Esmaili, Majid Asgharzadeh, Tamkin Shahraki, Neda Aligoli Ghasemabadi, Reza Falahatkar, Parham Mashouf, and Alireza Jafari. "Pediatrics Infected with COVID-19: A Case Series Study on Pediatrics Hospitalized in a Referral Pediatric Hospital." International Journal of Pediatrics 2021 (2021).
- [10] Tohidi, Sepehr, Elham Bidabadi, Mohammad-Javad Khosousi, Melika Amoukhteh, Maryam Kousha, Parham Mashouf, and Tamkin Shahraki. "Effects of iron supplementation on attention deficit hyperactivity disorder in children treated with methylphenidate." Clinical Psychopharmacology and Neuroscience 19, no. 4 (2021): 712.
- [11] Falahatkar, Reza, Tamkin Shahraki, Siavash Falahatkar, Samaneh Esmaceli, and Parham Mashouf. "Evaluating outcomes of complete supine percutaneous nephrolithotomy for staghorn vs multiple non-staghorn renal stones: a 10-year study." World Journal of Urology (2021): 1-7.
- [12] Arabtelgerd, Zahra, Abbasali Koochakzadeh, Mojtaba Naderi Soorki, and Seyed Mohammad Yasoubi. "Path Tracking Control of Bioflexible Probes Exposed to Uncertainties and Internal Tissues Disturbances with Unknown Upper Bonds Using Robust-Adaptive Sliding Mode Control." In Control Engineering in Mechatronics, pp. 103-121. Singapore: Springer Nature Singapore, 2023.
- [13] Koochakzadeh, Abbasali, Mojtaba Naderi Soorki, Aydin Azizi, Kamran Mohammadsharifi, and Mohammadreza Riazat. "Delay-Dependent Stability Region for the Distributed Coordination of Delayed Fractional-Order Multi-Agent Systems." Mathematics 11, no. 5 (2023): 1267.
- [14] Vande Kamp, Levi, Abbasali Koochakzadeh, Yasin Yazicioglu, and Derya Aksaray. "A Game Theoretic Approach to Distributed Planning of Multi-Agent Systems under Temporal Logic Specifications." In AIAA SCITECH 2023 Forum, p. 1657. 2023.

- [15] Riazat, Mohammadreza, Aydin Azizi, Mojtaba Naderi Soorki, and Abbasali Koochakzadeh. "Robust Consensus in a Class of Fractional-Order Multi-Agent Systems with Interval Uncertainties Using the Existence Condition of Hermitian Matrices." *Axioms* 12, no. 1 (2023): 65.
- [16] Koochakzadeh, Abbasali, and Yasin Yazıcıoğlu. "Priority based synchronization for faster learning in games." In *2022 IEEE 61st Conference on Decision and Control (CDC)*, pp. 2500-2505. IEEE, 2022.
- [17] Sobhanifard, Yaser, and Khashayar Eshtiaghi. "Exploratory modelling and ranking of the trust factors of messages about organic foods in social networks." *British Food Journal* 123, no. 2 (2021): 594-609.
- [18] Tabesh, Mahmood, and Maryam S. Sakhaeifar. "Local calibration and Implementation of AASHTOWARE Pavement ME performance models for Oklahoma pavement systems." *International Journal of Pavement Engineering* (2021): 1-12.
- [19] Dadashova, Bahar, Chiara Silvestri Dobrovolny, and Mahmood Tabesh. "Detecting Pavement Distresses Using Crowdsourced Dashcam Camera Images." (2021).
- [20] Sakhaeifar, Maryam, Mahmood Tabesh, David Newcomb, Robert Lytton, Dan Zollinger, and Isaa Mahmoud Issa. *Compilation of local studies and regional calibration of pavement ME design for rigid and Flexible pavements in oklahoma*. No. FHWA-OK-2277. Oklahoma. Department of Transportation, 2019.
- [21] Fallah, Arash Mohammadi, et al. "Novel Neural Network Optimized by Electrostatic Discharge Algorithm for Modification of Buildings Energy Performance." *Sustainability* 15.4 (2023): 2884.
- [22] Ghafourian, Ehsan, et al. "An Ensemble Model for the Diagnosis of Brain Tumors through MRIs." *Diagnostics* 13.3 (2023): 561.
- [23] Fatemi, Saeed, Mohammad Zarei, Seyed Ali Ziaee, Rouzbeh Shad, Seyed Amir Saadatjoo, and Ehsan Tabasi. "Low and intermediate temperatures fracture behavior of amorphous poly alpha olefin (PAO)-modified hot mix asphalt subjected to constant and variable temperatures." *Construction and Building Materials* 364 (2023): 129840.
- [24] Xiong, Feng, Mohammad Zarei, Ehsan Tabasi, Alireza Naseri, Mohammad Worya Khordehbinan, and Teeba Ismail Kh. "Effect of nano-reduced graphene oxide (NRGO) on long-term fracture behavior of Warm Mix Asphalt (WMA)." *Construction and Building Materials* 392 (2023): 131934.
- [25] Tabasi, Ehsan, Mohammad Zarei, Hossein Alaei, Mohsen Tarafdar, Farah Qasim Ahmed Alyousuf, and Mohammad Worya Khordehbinan. "Evaluation of long-term fracture behavior of hot mix asphalt modified with Nano reduced graphene oxide (RGO) under freeze-thaw damage and aging conditions." *Construction and Building Materials* 374 (2023): 130875.
- [26] Tabasi, Ehsan, Mohammad Zarei, Zahra Mobasheri, Alireza Naseri, Hossein Ghafourian, and Mohammad Worya Khordehbinan. "Pre-and post-cracking behavior of asphalt mixtures under modes I and III at low and intermediate temperatures." *Theoretical and Applied Fracture Mechanics* 124 (2023): 103826.
- [27] Tabarkhoun, Farnaz, et al. "Synthesis of novel and tunable Micro-Mesoporous carbon nitrides for Ultra-High CO₂ and H₂S capture." *Chemical Engineering Journal* 456 (2023): 140973.
- [28] Afshari, F., and M. Maghasedi. "Rhomboidal C₄C₈ toris which are Cayley graphs." *Discrete Mathematics, Algorithms and Applications* 11.03 (2019): 1950033.
- [29] Afshari, Fatemeh, and Mohammad Maghasedi. "On the eigenvalues of Cayley graphs on generalized dihedral groups." *Algebraic Structures and Their Applications* 6, no. 2 (2019): 39-45.
- [30] AFSHARI, FATEME, and MOHAMMAD MAGHASEDI. "Groups and chemical Cayley graphs." In *BOOK OF ABSTRACTS*, p. 23. 2017.
- [31] Behseresht, Saeed, and Mehdi Mehdizadeh. "Mode I&II SIFs for semi-elliptical crack in a cylinder wrapped with a composite layer." The 28th Annual International Conference of Iranian Society of Mechanical Engineers-ISME2020 27-29 May, 2020, Tehran, Iran (2020)
- [32] Behseresht, Saeed, and Mehdi Mehdizadeh. "Stress intensity factor interaction between two semi-elliptical cracks in thin-walled cylinder." The 28th Annual International Conference of Iranian Society of Mechanical Engineers-ISME2020 27-29 May, 2020, Tehran, Iran (2020)
- [33] Sharifani, Koosha and Mahyar Amini. "Machine Learning and Deep Learning: A Review of Methods and Applications." *World Information Technology and Engineering Journal* 10.07 (2023): 3897-3904.
- [34] Nazari Enjedani, Somayeh, and Mahyar Amini. "The role of traffic impact effect on transportation planning and sustainable traffic management in metropolitan regions." *International Journal of Smart City Planning Research* 12, no. 2023 (2023): 688-700.
- [35] Amini, Mahyar and Ali Rahmani. "How Strategic Agility Affects the Competitive Capabilities of Private Banks." *International Journal of Basic and Applied Sciences* 10.01 (2023): 8397-8406.
- [36] Amini, Mahyar and Ali Rahmani. "Achieving Financial Success by Pursuing Environmental and Social Goals: A Comprehensive Literature Review and Research Agenda for Sustainable Investment." *World Information Technology and Engineering Journal* 10.04 (2023): 1286-1293.
- [37] Amini, Mahyar, and Zavareh Bozorgasl. "A Game Theory Method to Cyber-Threat Information Sharing in Cloud Computing Technology." *International Journal of Computer Science and Engineering Research* 11.4 (2023): 549-560.
- [38] Jahanbakhsh Javid, Negar, and Mahyar Amini. "Evaluating the effect of supply chain management practice on implementation of halal agroindustry and competitive advantage for small and medium enterprises." *International Journal of Computer Science and Information Technology* 15.6 (2023): 8997-9008
- [39] Amini, Mahyar, and Negar Jahanbakhsh Javid. "A Multi-Perspective Framework Established on Diffusion

- of Innovation (DOI) Theory and Technology, Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises." *International Journal of Information Technology and Innovation Adoption* 11.8 (2023): 1217-1234
- [40] Amini, Mahyar and Ali Rahmani. "Agricultural databases evaluation with machine learning procedure." *Australian Journal of Engineering and Applied Science* 8.6 (2023): 39-50
- [41] Amini, Mahyar, and Ali Rahmani. "Machine learning process evaluating damage classification of composites." *International Journal of Science and Advanced Technology* 9.12 (2023): 240-250
- [42] Amini, Mahyar, Koosha Sharifani, and Ali Rahmani. "Machine Learning Model Towards Evaluating Data gathering methods in Manufacturing and Mechanical Engineering." *International Journal of Applied Science and Engineering Research* 15.4 (2023): 349-362.
- [43] Sharifani, Koosha and Amini, Mahyar and Akbari, Yaser and Aghajanzadeh Godarzi, Javad. "Operating Machine Learning across Natural Language Processing Techniques for Improvement of Fabricated News Model." *International Journal of Science and Information System Research* 12.9 (2022): 20-44.
- [44] Amini, Mahyar, et al. "MAHAMGOSTAR.COM AS A CASE STUDY FOR ADOPTION OF LARAVEL FRAMEWORK AS THE BEST PROGRAMMING TOOLS FOR PHP BASED WEB DEVELOPMENT FOR SMALL AND MEDIUM ENTERPRISES." *Journal of Innovation & Knowledge, ISSN* (2021): 100-110.
- [45] Amini, Mahyar, and Aryati Bakri. "Cloud computing adoption by SMEs in the Malaysia: A multi-perspective framework based on DOI theory and TOE framework." *Journal of Information Technology & Information Systems Research (JITISR)* 9.2 (2015): 121-135.
- [46] Amini, Mahyar, and Nazli Sadat Safavi. "A Dynamic SLA Aware Heuristic Solution for IaaS Cloud Placement Problem Without Migration." *International Journal of Computer Science and Information Technologies* 6.11 (2014): 25-30.
- [47] Amini, Mahyar. "The factors that influence on adoption of cloud computing for small and medium enterprises." (2014).
- [48] Amini, Mahyar, et al. "Development of an instrument for assessing the impact of environmental context on adoption of cloud computing for small and medium enterprises." *Australian Journal of Basic and Applied Sciences (AJBAS)* 8.10 (2014): 129-135.
- [49] Amini, Mahyar, et al. "The role of top manager behaviours on adoption of cloud computing for small and medium enterprises." *Australian Journal of Basic and Applied Sciences (AJBAS)* 8.1 (2014): 490-498.
- [50] Amini, Mahyar, and Nazli Sadat Safavi. "A Dynamic SLA Aware Solution for IaaS Cloud Placement Problem Using Simulated Annealing." *International Journal of Computer Science and Information Technologies* 6.11 (2014): 52-57.
- [51] Sadat Safavi, Nazli, Nor Hidayati Zakaria, and Mahyar Amini. "The risk analysis of system selection and business process re-engineering towards the success of enterprise resource planning project for small and medium enterprise." *World Applied Sciences Journal (WASJ)* 31.9 (2014): 1669-1676.
- [52] Sadat Safavi, Nazli, Mahyar Amini, and Seyyed AmirAli Javadinia. "The determinant of adoption of enterprise resource planning for small and medium enterprises in Iran." *International Journal of Advanced Research in IT and Engineering (IJARIE)* 3.1 (2014): 1-8.
- [53] Sadat Safavi, Nazli, et al. "An effective model for evaluating organizational risk and cost in ERP implementation by SME." *IOSR Journal of Business and Management (IOSR-JBM)* 10.6 (2013): 70-75.
- [54] Safavi, Nazli Sadat, et al. "An effective model for evaluating organizational risk and cost in ERP implementation by SME." *IOSR Journal of Business and Management (IOSR-JBM)* 10.6 (2013): 61-66.
- [55] Amini, Mahyar, and Nazli Sadat Safavi. "Critical success factors for ERP implementation." *International Journal of Information Technology & Information Systems* 5.15 (2013): 1-23.
- [56] Amini, Mahyar, et al. "Agricultural development in IRAN base on cloud computing theory." *International Journal of Engineering Research & Technology (IJERT)* 2.6 (2013): 796-801.