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Quantum Computing for Cancer Diagnosis Optimization Using Medical Imaging and Neural Network Models

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Abstract:

The integration of quantum computing with neural network models offers a transformative approach to cancer diagnosis, particularly in the analysis of medical imaging data. This study proposes a novel diagnostic framework that leverages quantum computing to optimize deep neural networks for enhanced image classification and tumor detection. Medical imaging datasets, including MRI and CT scans, are processed using hybrid quantum-classical models to improve computational efficiency and diagnostic precision. Quantum machine learning algorithms, such as Quantum Support Vector Machines (QSVM) and Variational Quantum Circuits (VQC), are employed to accelerate feature extraction and classification tasks. The neural network models are further refined using quantum-enhanced optimization techniques, leading to faster convergence and improved diagnostic accuracy. Experimental evaluations reveal that the proposed framework significantly outperforms classical models in detecting cancerous patterns with reduced computational overhead, offering promising implications for clinical oncology.

Keywords:

Quantum computing, cancer diagnosis, medical imaging, neural networks, diagnostic optimization, quantum machine learning.

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REFERENCES

[1] El-Kenawy, E. S. M., Ibrahim, A., Mirjalili, S., Eid, M. M., & Hussein, S. E. (2020). Novel feature selection and voting classifier algorithms for COVID-19 classification in CT images. IEEE access, 8, 179317-179335.

[2] El-Kenawy, E. S. M., Eid, M. M., Saber, M., & Ibrahim, A. (2020). MbGWO-SFS: Modified binary grey wolf optimizer based on stochastic fractal search for feature selection. IEEE Access, 8, 107635-107649.

[3] El-Kenawy, E. S., & Eid, M. (2020). Hybrid gray wolf and particle swarm optimization for feature selection. Int. J. Innov. Comput. Inf. Control, 16(3), 831-844.

[4] El-Kenawy, E. S. M., Khodadadi, N., Mirjalili, S., Abdelhamid, A. A., Eid, M. M., & Ibrahim, A. (2024). Greylag goose optimization: nature-inspired optimization algorithm. Expert Systems with Applications, 238, 122147.

[5] El-Kenawy, E. S. M., Mirjalili, S., Ibrahim, A., Alrahmawy, M., El-Said, M., Zaki, R. M., & Eid, M. M. (2021). Advanced meta-heuristics, convolutional neural networks, and feature selectors for efficient COVID-19 X-ray chest image classification. Ieee Access, 9, 36019-36037.

[6] Abdelhamid, A. A., El-Kenawy, E. S. M., Khodadadi, N., Mirjalili, S., Khafaga, D. S., Alharbi, A. H., ... & Saber, M. (2022). Classification of monkeypox images based on transfer learning and the Al-Biruni Earth Radius Optimization algorithm. Mathematics, 10(19), 3614.

[7] Ibrahim, A., Mirjalili, S., El-Said, M., Ghoneim, S. S., Al-Harthi, M. M., Ibrahim, T. F., & El-Kenawy, E. S. M. (2021). Wind speed ensemble forecasting based on deep learning using adaptive dynamic optimization algorithm. IEEE Access, 9, 125787-125804.

[8] El-Kenawy, E. S. M., Mirjalili, S., Alassery, F., Zhang, Y. D., Eid, M. M., El-Mashad, S. Y., ... & Abdelhamid, A. A. (2022). Novel meta-heuristic algorithm for feature selection, unconstrained functions and engineering problems. IEEE Access, 10, 40536-40555.

[9] Abdelhamid, A. A., El-Kenawy, E. S. M., Alotaibi, B., Amer, G. M., Abdelkader, M. Y., Ibrahim, A., & Eid, M. M. (2022). Robust speech emotion recognition using CNN+ LSTM based on stochastic fractal search optimization algorithm. Ieee Access, 10, 49265-49284.

[10] Abdollahzadeh, B., Khodadadi, N., Barshandeh, S., Trojovský, P., Gharehchopogh, F. S., El-kenawy, E. S. M., ... & Mirjalili, S. (2024). Puma optimizer (PO): a novel metaheuristic optimization algorithm and its application in machine learning. Cluster Computing, 27(4), 5235-5283.

[11] Eid, M. M., El-kenawy, E. S. M., & Ibrahim, A. (2021, March). A binary sine cosine-modified whale optimization algorithm for feature selection. In 2021 National Computing Colleges Conference (NCCC) (pp. 1-6). IEEE.

[12] El-Kenawy, E. S. M., Mirjalili, S., Abdelhamid, A. A., Ibrahim, A., Khodadadi, N., & Eid, M. M. (2022). Meta-heuristic optimization and keystroke dynamics for authentication of smartphone users. Mathematics, 10(16), 2912.

[13] Abdelhamid, A. A., Towfek, S. K., Khodadadi, N., Alhussan, A. A., Khafaga, D. S., Eid, M. M., & Ibrahim, A. (2023). Waterwheel plant algorithm: a novel metaheuristic optimization method. Processes, 11(5), 1502.

[14] Alhussan, A. A., Abdelhamid, A. A., El-Kenawy, E. S. M., Ibrahim, A., Eid, M. M., Khafaga, D. S., & Ahmed, A. E. (2023). A binary waterwheel plant optimization algorithm for feature selection. IEEE Access, 11, 94227-94251.

[15] Hassib, E. M., El-Desouky, A. I., Labib, L. M., & El-Kenawy, E. S. M. (2020). WOA+ BRNN: An imbalanced big data classification framework using Whale optimization and deep neural network. soft computing, 24(8), 5573-5592.

[16] El-Kenawy, E. S. M., Abdelhamid, A. A., Ibrahim, A., Mirjalili, S., Khodadad, N., Alduailij, M. A., ... & Khafaga, D. S. (2023). Al-Biruni Earth Radius (BER) Metaheuristic Search Optimization Algorithm. Comput. Syst. Sci. Eng., 45(2), 1917-1934.

[17] Alharbi, A. H., Towfek, S. K., Abdelhamid, A. A., Ibrahim, A., Eid, M. M., & Khafaga, D. S. & Saber, M.(2023). Diagnosis of Monkeypox Disease Using Transfer Learning and Binary Advanced Dipper Throated Optimization Algorithm. Biomimetics, 8(3), 313.

[18] El-Kenawy, E. S. M., Mirjalili, S., Khodadadi, N., Abdelhamid, A. A., Eid, M. M., El-Said, M., & Ibrahim, A. (2023). Feature selection in wind speed forecasting systems based on meta-heuristic optimization. Plos one, 18(2), e0278491.

[19] Khodadadi, N., Abualigah, L., El-Kenawy, E. S. M., Snasel, V., & Mirjalili, S. (2022). An archive-based multi-objective arithmetic optimization algorithm for solving industrial engineering problems. IEEE Access, 10, 106673-106698.

[20] Eid, M. M., El-Kenawy, E. S. M., Khodadadi, N., Mirjalili, S., Khodadadi, E., Abotaleb, M., ... & Khafaga, D. S. (2022). Meta-heuristic optimization of LSTM-based deep network for boosting the prediction of monkeypox cases. Mathematics, 10(20), 3845.

[21] Khodadadi, N., Khodadadi, E., Al-Tashi, Q., El-Kenawy, E. S. M., Abualigah, L., Abdulkadir, S. J., ... & Mirjalili, S. (2023). BAOA: binary arithmetic optimization algorithm with K-nearest neighbor classifier for feature selection. IEEE Access, 11, 94094-94115.

[22] Salamai, A. A., El-kenawy, E. S. M., & Abdelhameed, I. (2021). Dynamic voting classifier for risk identification in supply chain 4.0. Computers, Materials & Continua, 69(3).

[23] Djaafari, A., Ibrahim, A., Bailek, N., Bouchouicha, K., Hassan, M. A., Kuriqi, A., ... & El-Kenawy, E. S. M. (2022). Hourly predictions of direct normal irradiation using an innovative hybrid LSTM model for concentrating solar power projects in hyper-arid regions. Energy Reports, 8, 15548-15562.