

Neural and Genetic Abnormalities

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Abstract—In this paper, we explore two different optimization problems: a neural network for the Iris dataset and a genetic algorithm for the SHUBERT function. We design, implement, and evaluate both optimization techniques, comparing their performance and discussing the advantages and disadvantages of each method. The artificial neural network is employed to classify iris flowers based on their morphological features, while the genetic algorithm is utilized to optimize the SHUBERT function, a well-known benchmark problem in the global optimization domain. By comparing the results of these two distinct optimization approaches, we provide insights into their applicability and effectiveness in solving different types of problems.

Index Terms—Machine Learning, Deep Learning, Neural Networks, Genetic Algorithms, Classification, Iris, Optimisation

I. INTRODUCTION

In recent years, optimization techniques have gained significant attention due to their wide range of applications in various fields such as machine learning, engineering, and finance. Among these techniques, artificial neural networks (ANNs) and genetic algorithms (GAs) have emerged as powerful tools for solving complex problems. This paper explores the application of ANNs to classify the Iris dataset, a well-known benchmark problem in machine learning, and the use of GAs to optimize the SHUBERT function, a challenging global optimization problem. By comparing the performance of these two distinct optimization methods, we aim to provide a deeper understanding of their strengths and weaknesses, as well as their suitability for different types of problems. This paper will cover the design, implementation, evaluation, and comparison of ANNs and GAs in the context of the Iris dataset classification and SHUBERT function optimization.

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An excellent style manual for science writers is [7].

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citation [6].

Fig. 1. Example of a figure caption.

REFERENCES

- [1] G. Eason, B. Noble, and I. N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529–551, April 1955.
- [2] J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

- [3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in *Magnetism*, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
- [4] K. Elissa, "Title of paper if known," unpublished.
- [5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.
- [6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," *IEEE Transl. J. Magn. Japan*, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetism Japan, p. 301, 1982].
- [7] M. Young, *The Technical Writer's Handbook*. Mill Valley, CA: University Science, 1989.

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