TO WHOM IT MAY CONCERN

MEMBERS OF SCIENTIFIC COMMUNITY

WOLVES OF SCIENCE, ENGINEERING, AND TECHNOLOGY

Dear colleagues:

I hope my letter finds you well. My name is REFAT ESHAQ (https://orcid.org/0000-0002-6448-4054). My nickname is Wolf's Mind. I have created a new algorithm, namely Proportional–Integral–Derivative–Cumulative Neural Network (PIDC-NN), also called MinerNet. This algorithm work based on the PID controller that was created by the inventor Elmer Sperry in 1910. The code has been released on **GitHub**, see https://github.com/REFATESHAQ/PIDC-NN_MinerNet . The data (Coal and Gangue Infrared Images in BMP file format (Data.zip)) have been released on **IEEE Dataport**, see https://dx.doi.org/10.21227/v3m7-dk11.

Although convolutional neural networks (CNNs) have achieved great successes in computer vision and pattern recognition, they have some shortcomings. In this article, a novel deep learning algorithm for binary classification is proposed to distinguish between coal and gangue infrared images. First, a Proportional–Integral–Derivative–Cumulative (PIDC) algorithm is created, which works based on the concept of a PID controller, in order to quickly extract features from infrared images and also to control the performance of Artificial Neural Networks (ANNs). Second, an ANN is designed for binary classification tasks (coal/gangue). Third, the PIDC algorithm and the ANN algorithm are connected to create a new learning system, namely, the Proportional–Integral–Derivative–Cumulative Neural Network (PIDC-NN), also called MinerNet. The proposed PIDC-NN architecture works without any traditional layers of deep CNNs such as convolutional layers, nonlinear activation functions layers, batch normalization layers, polling layers, or dropout layers. The results of the training and test processes demonstrate that the proposed PIDC-NN architecture alleviates the oscillation and overfitting problems of existing CNNs. Moreover, it solves the problem of dead neurons and big data that are required to train CNNs. Additionally, it provides robust and resilient control by tuning the gain coefficients K_P, K_I, and K_D; the sampling time (dt); and arbitrary value (AV). A comparison between the proposed PIDC-NN architecture and state-of-the-art CNNs proves the effectiveness of the proposed method in accelerating both the training and test processes with competitive loss and accuracy.

I emphasize that this algorithm (PIDC) that I created through my own effort, can provide optimal control to any system (not only ANN) whether linear or nonlinear with multiple inputs. Furthermore, this algorithm (PIDC) can control multiple complicated random inputs and make the system linear even with inputs, their amounts, and values are huge numbers (goes to infinity).

This work has been supported by my livelihood and my family's aid. The code and data are connected to the article, entitled "**Deep Learning Algorithm for Computer Vision with a New Technique and Concept: PIDC-NN for Binary Classification Tasks in a Coal Preparation Plant (MinerNet)**" TechRxiv (10.36227/techrxiv.23266301).

For the introduction, methodology, and results. You can see the article Deep Learning Algorithm for Computer Vision with a New Technique and Concept: PIDC-NN for Binary Classification Tasks in a Coal Preparation Plant (MinerNet) (techrxiv.org)

The question is, why do I make contact with you?

As the average review time in top journals for the first round of submission may exceed one year, they encourage the authors to submit their papers to TechRxiv, IEEE's preprint server, and publish the code in GitHub platform in order to quickly disseminate their work to a wide audience and gain community feedback. Therefore:

- If you are a researcher in medicine, you can use and develop this code to detect the cancers Benign and Malignant Tumors by using the dataset of breast mammography images as inputs to the PIDC-NN algorithm.
- If you are a researcher in Ecological and Environmental Engineering, you can use and develop this code to study geological and climate changes by using Remote Sensing Images as inputs to the PIDC-NN algorithm.
- If you are a researcher in Mining Engineering, you can use and develop this code to detect and explore the resources by using images you collected as inputs to the PIDC-NN algorithm.
- If you are a researcher in Mechanical or Industrial Engineering, you can use and develop this code to remove unwanted material from production lines of factories or to detect defects in equipment. Also who work in Fluid Mechanics and Gas Dynamics, you can use this code in order to study the behavior of fluid by using infrared images of the movement of the fluid through the pipes and heat exchangers.
- If you are a researcher in Mechatronics Engineering, you can use and develop this code and insert it in Robots as visual sense algorithm such as Robotic Arms (Manipulators), Mobile Robots, and Drones and so on.

Finally, there are a lot of benefits from this algorithm (PIDC) to control thermal, electrical, and mechanical processes as long as you understand how the PIDC algorithm deal with multiple random complicated inputs to produce one or multiple stable outputs. To clarify, the PIDC algorithm can not only apply to control ANN but also to any system need to be stable.

Yours faithfully

ESHAQ

"He was born in June 2, 1993. Having fished general secondary school, he traveled to the Republic of Egypt to study mechanical engineering, and he received a bachelor's degree in mechanical engineering, in January 2018. He studied mechatronic engineering in the People's Republic of China, and received a master's degree of engineering in mechatronic engineering, in June 2021. He is currently pursuing a PhD degree at school of mechanical and electrical engineering, in the People's Republic of China, his major area of study is mechatronic engineering. In spare time, he is working on his own project to build a company of artificial intelligence that specializes in computer vision and control theory. He has been serving as a reviewer for top peer-reviewed journal "Applied Energy" which is ranked as one of the ten best journals over the world in the fields of mechanical engineering, building and construction engineering, and energy. His research interests include thermal radiation, infrared imaging, computer vision, image processing, machine learning, deep learning, neural networks, and control theory (PID controllers)".

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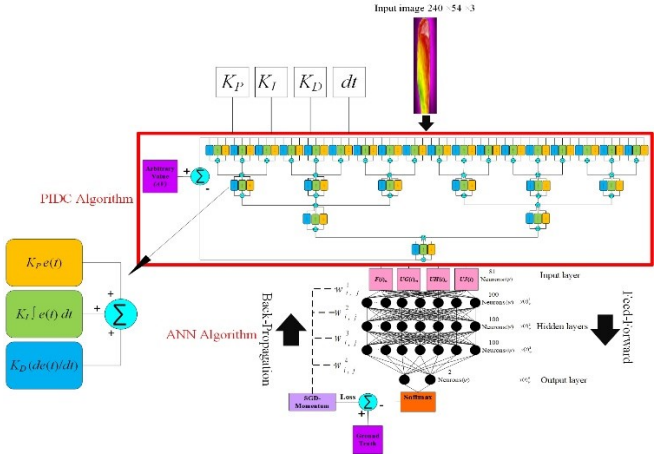

PIDC-NN (MinerNet) for Binary Classification Tasks