Research Assessment #10

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Weiss, R., Karimijafarbigloo, S., Roggenbuck, D., & Rödiger, S. (2022). Applications of Neural Networks in Biomedical Data Analysis. Biomedicines, 10(1469). https://doi.org/10.3390/biomedicines10071469

Assessment: Research Assessment #9

For my research assessment, I reviewed a paper detailing how neural networks can be used in biomedical research. The research paper provides a complete overview of neural networks and their applications in biomedical data analysis. The researchers talk about the structure and the function of the artificial neural networks, the role of different mathematical functions, and optimization algorithms. They talk about how the information can be used to perform tasks like image segmentation, biomarker identification, and forensics. This mainly shows this technology's impact in the biomedical and healthcare fields. The paper emphasizes using deep learning models like convolutional neural networks to carry out many tasks throughout the paper.

This information is relevant to my learning as it helps me understand how machine learning models can process complex data, such as bioimages and biomarkers, which I will work with when I create my model for stem cell differentiation. It also details the practical tools, techniques, and neural networks, such as convolutional neural networks (CNNs), which can support my ISM journey by helping me create my own CNN model in regenerative medicine.

The paper discusses neural network architectures and how to develop and use the network. Moreover, the numerous mathematical techniques and functions listed and explained in the paper can be a reference while creating my project. The information discussed in this paper, especially about the different neural network tools and techniques, serves as a foundation for me as I build and create my neural network.

The paper breaks down the information into easily understandable parts: introduction, bioimage informatics, activation functions, optimization algorithms, challenges, and finally, real-world applications. This helps break down the concept into components like neurons, layers, training algorithms, and activation functions (e.g., sigmoid, ReLU) so that they are easier to understand. The paper compares the efficiency of optimizers like Adam and Adadelta and evaluates the network architectures of different neural networks for various tasks. Compared to my prior knowledge, the papers help me understand the inner workings of machine learning and add depth, particularly in understanding how adaptive learning affects real-world data challenges like noise and computational complexity. Before reading this paper, I was not fully aware of the different tools and techniques it talked about, so my research in this paper helped me get a better understanding of the math behind machine learning as well.

I can more confidently create my neural network with this information from the research paper. With this information, I implement the optimization functions and other tools that they mentioned in my work when creating CNN-based models for detecting cellular patterns in regenerative medicine or using RNNs to analyze sequential data. These tools merge with my understanding of the biology behind stem cell differentiation and help me understand how to frame the tools they discussed for my specific project. A few new questions include optimizing

neural networks for rare data and implementing explainable AI to understand the differentiation pathway.

The research paper effectively supports my goals by providing actionable tasks and cementing the role of neural networks in advancing my biomedical research. The detailed explanation of network types and optimization methods was particularly motivating, though the challenges of interpretability and data dependency showed me the critical considerations for my future work. This new knowledge was beneficial in reaching my goals as it helped me understand the full extent of the architecture of these neural networks.