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Abstract:

Erythrocyte morphology is gaining importance as a powerful pathological index in identifying the severity of any blood related disease. However, the existing technique of quantitative microscopy is highly time consuming and prone to personalized bias. On the other hand, relatively unexplored, complementary technique based on flow cytometry has not been standardized till date, particularly due to the lack of a proper morphological scoring scale. In this article, we have presented a new approach to formulate a non-empirical scoring scale based on membrane roughness (R_{rms}) data obtained from atomic force microscopy. Subsequently, the respective morphological quantifier of the whole erythrocyte population, commonly known as morphological index, was expressed as a function of highest correlated statistical parameters of scattered signal profiles generated by flowcytometry. Feed forward artificial neural network model with multilayer perceptron architecture was used to develop the intended functional form. High correlation coefficient (R^2=0.95), even for model-formulation exclusive samples, clearly indicates the universal validity of the proposed model. Moreover, a direct pathological application of the proposed model has been illustrated in relation to patients, diagnosed to be suffering from a wide variety of cancer.

Keywords: erythrocyte morphology, membrane roughness, atomic force microscopy, morphological scale, flow cytometry, neural network model.

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