

## Chapter 5

# Multi-Criteria Decision-Making Techniques for Histopathological Image Classification

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### ABSTRACT

*This chapter presents an overview of methods that have been proposed for analysis of histopathological images. Diagnosing and detecting abnormalities in medical images helps the pathologist in making better decisions. Different machine learning algorithms such as  $k$ -nearest neighbor, random forest, support vector machine, ensemble learning, multilayer perceptron, and convolutional neural network are incorporated for carrying out the analysis process. Further, multi-criteria decision-making (MCDM) methods such as SAW, WPM, and TOPSIS are used to improve the efficiency of the decision-making process.*

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## **INTRODUCTION**

Over past decades, determination of diseased histopathological image has become a difficult task for radiologists. Image analysis with computer aided analytical approaches for diagnosis play a major rule in present era (Barik, Dubey, Misra, Borthakur, Constant, Sasane, & Mankodiya, 2018). Histopathology refers a minute identification of a tissue in order to learn the symptom of a disease which is being carried out from biopsy examination or by a surgical specimen. The process highly depends on radiologist or pathologist's opinion which becomes a hectic issue in some preliminary cases. To add up with manual result, a computational environment is recommended for working in digitized tissue histopathological images. As microscopic images have a momentous role for visualizing and interpreting the cells and tissues, image analysis is opted in this chapter with new machine learning techniques and decision making algorithms incorporated together for disease detection, diagnosis and prognosis prediction which can aid the physician's opinion. In addition, this chapter also deals quantitative characterization and analysis of pathological imagery which is important for clinical and research application to reduce variations in diagnosis and to comprehend the biological mechanism of disease. This chapter mainly focuses on method to identify the categories by classification into favorable or unfavorable tissue morphology and multicriteria decision making method assists with it to correctly diagnose the diseased tissue for further treatment planning. This chapter also includes experimental analysis results of various classification algorithms with multicriteria decision making techniques to determine class labels with high accuracy (Blessa Binolin Pepsi & Bargavi, 2017). Overall design of this chapter is presented in Figure 1.

## **BACKGROUND**

Automated histopathological image data analysis is a research to complement the pathological diagnosis process thereby to relieve their workload. Once preprocessing has been performed, data analytics is carried out to the histopathological image which is one of challenge that is discussed in detail in this chapter (Panigrahi, Tiwary, Pati, & Das, 2016; Sarkhel, Das & Vashishtha, 2017). The techniques are applied on training samples to classify the images which are facilitated by machine learning approaches. Further the pre trained model can be made accurate using decision making algorithms. The performance of the algorithms is measured using experimental analysis. The results define the efficiency and effectiveness of the multi criteria decision making approach for histopathological image classification.

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