CHAPTER I
INTRODUCTION

1.1. Background

Fake news (hoax) is one of the big problems in today's digital world, with a significant impact on public perception and decision-making[1]. The spread of fake news not only has an impact on social life, but also threatens the country's political, economic, and security stability. One type of fake news that is growing rapidly is one that is image-based with text overlay (e.g., images with manipulated text)[2]. On many social media platforms, these images are often used to spread false or misleading information[3].

Image-based fake news detection is crucial, as images tend to be easier to share and get noticed faster. As technology develops, image-based detection techniques are becoming more sophisticated, and an approach that is able to handle the complexity of images and text in detecting information manipulation is needed[3]. However, the big challenge is how to identify images that contain fake text or images that are manipulated so that it is difficult to distinguish between the real and the fake[4].

Many image-based fake news detection systems today still rely on traditional methods that focus on analyzing images or text separately[5]. However, this method tends to be less effective in dealing with the complex relationship between images and text. In addition, the methods in place are often not accurate enough, especially if the image is of low quality, high resolution, or if the text is overlaid in a very subtle way[6]. Therefore, a more integrated approach is needed to detect manipulation in both images and text simultaneously.

This study proposes the implementation of Learning Vector Quantization (LVQ) for image-based classification of fake news, with GLCM (Gray Level Co-occurrence Matrix) feature extraction for image texture analysis[7]. LVQ was chosen for its ability to handle learning-based classification with large datasets and complex variables, which are often found in image-based fake news detection[8]. GLCM is used to extract texture features from images that will help LVQ in distinguishing between original images and images that have been manipulated[9].

The GLCM method works to detect finer texture patterns, which are often indicators of manipulation in the image. By analyzing features such as contrast,

correlation, energy, and homogeneity, GLCM can help identify subtle differences in image texture that could be a sign of unauthorized image manipulation or processing[10].

Research [11], developed a model for the classification of tea leaf diseases using a combination of Learning Vector Quantization (LVQ) and Linear Discriminant Analysis (LDA). This model relies on Gray Level Co-occurrence Matrix (GLCM) feature extraction and color analysis using the Mean Color method to identify tea leaf diseases. In this study, the LVQ model managed to achieve an accuracy of 94.1%, which demonstrates the potential of this method in effective image-based classification, as well as its ability to handle data with high complexity. Legitimate Research [12], This study focuses on the classification of pepper leaf disease using LVQ based on digital image processing. The process starts with image pre-processing, conversion to CIELAB color space, segmentation using Otsu Thresholding, and extraction of color and texture features using GLCM. The developed LVQ model achieves an overall accuracy of 90.83%, with the best performance in recognizing healthy leaves. Although there are variations in performance between classes, the model demonstrates effectiveness in the classification of plant diseases with limited datasets and handles non-linear data well.

In addition to the technical challenges that have been described, the urgency of this research is increasing as the rate of disinformation is much faster than manual verification capabilities. In a matter of minutes, an image of fake news can spread widely through social media and messaging apps, reaching thousands or even millions of users before it can be confirmed to be true. The impact not only causes public confusion, but also has the potential to trigger social conflict, collective panic, and loss of trust in official institutions.

Therefore, this study aims to develop a more efficient and effective image-based fake news detection model using a combination of LVQ and GLCM. With this approach, it is hoped that it will be possible to obtain models that are not only fast in classifying, but also more accurate in detecting images that have been manipulated or given false text.

This research is expected to contribute to the development of a more efficient image-based fake news detection system, as well as provide a new approach that can be implemented on social media platforms in reducing the spread of fake news.

1.2. Problem Formulation

Based on this background, several research problems that will be answered in the thesis can be formulated, including:

1. How can the application of the Learning Vector Quantization (LVQ) algorithm be used for the classification of images containing fake news with text overwrites, based on texture and color features extracted using the Gray Level Co-occurrence Matrix (GLCM)?
2. How can GLCM feature extraction support LVQ in detecting fake news on images that contain text, especially in detecting texture changes due to image manipulation?
3. How does the LVQ-GLCM model perform in detecting image-based fake news when evaluated using accuracy, precision, recall, and F1-Score metrics?
4. How does the LVQ-GLCM model implement using Streamlit for image-based fake news detection?

1.3.Research Objectives

The objectives of the thesis with the title "Implementation of the Learning Vector Quantization (LVQ) Method with GLCM Extraction for the Detection of Image-Based Fake News with Text Overwrite" are as follows:

1. Applying the Learning Vector Quantization (LVQ) algorithm in classifying images containing fake news with text overwrites, in order to handle the diversity of texture and color features extracted from images, as well as the complexity of the relationship between features in detecting image manipulation.
2. Optimize LVQ model performance through the application of Gray Level Co-occurrence Matrix (GLCM) feature extraction techniques to improve the accuracy of fake news image classification based on texture analysis and visual patterns in images.
3. Evaluate the performance of the LVQ-GLCM model in detecting image-based fake news using accuracy, precision, recall, and F1-Score metrics.
4. Implemented the LVQ-GLCM model using the Streamlit framework as a prototype of an image-based fake news detection tool.

1.4. Research Benefits

Some of the benefits that can be taken from the thesis entitled "Implementation of the Learning Vector Quantization (LVQ) Method with GLCM Extraction for Image-Based Fake News Detection with Overlay Text" include:

1. Provides an in-depth understanding of the application of the LVQ-GLCM method in the image classification system for the detection of image-based fake news with text overlays.
2. Provides a measurable evaluation of LVQ-GLCM model performance through the analysis of accuracy, precision, recall, and F1-Score metrics. The results of this evaluation can be an empirical reference in assessing the effectiveness of the LVQ-GLCM approach for the detection of news image manipulation.
3. Provide a ready-to-use web-based system prototype through implementation with the Streamlit framework to independently conduct a quick check of the authenticity of news images.
4. Supporting efforts to mitigate the spread of fake news on digital platforms. The resulting classification model and its implementation system can increase the effectiveness of the image content verification process automatically.

1.5.Problem Limitations

The limitations of the problem in the thesis research with the title "Implementation of the Learning Vector Quantization (LVQ) Method with GLCM Extraction for Image-Based Fake News Detection with Text Overwrite" are as follows:

1. The dataset used consists of images obtained through the internet, with two types in one image, namely the original document version and the text overwritten version.
2. The image used is a news thumbnail, and does not include any other images other than those related to the news or information.
3. It cannot detect the results of images generated by AI such as chat, gpt, gemini and other ai.