

Image Texture Feature Extraction Using GLCM Approach

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Abstract- Feature Extraction is a method of capturing visual content of images for indexing & retrieval. Primitive or low level image features can be either general features, such as extraction of color, texture and shape or domain specific features. This paper presents an application of gray level co-occurrence matrix (GLCM) to extract second order statistical texture features for motion estimation of images. The Four features namely, Angular Second Moment, Correlation, Inverse Difference Moment, and Entropy are computed using Xilinx FPGA. The results show that these texture features have high discrimination accuracy, requires less computation time and hence efficiently used for real time Pattern recognition applications.

Index Terms- Texture, Pattern recognition, Features, Frames.

I. INTRODUCTION

Feature extraction involves simplifying the amount of resources required to describe a large set of data accurately. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power or a classification algorithm which over fits the training sample and generalizes poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. Texture tactile or visual characteristic of a surface. Texture analysis aims in finding a unique way of representing the underlying characteristics of textures and represent them in some simpler but unique form, so that they can be used for robust, accurate classification and segmentation of objects. Though texture plays a significant role in image analysis and pattern recognition, only a few architectures implement on-board textural feature extraction. In this paper, Gray level co-occurrence matrix is formulated to obtain statistical texture features. A number of texture features may be extracted from the GLCM. Only four second order features namely angular second moment, correlation, inverse difference moment, and entropy are computed. These four measures provide high discrimination accuracy required for motion picture estimation. These features are calculated and implemented using Xilinx ISE 13.4.

II. EXTRACTION OF GLCM

In statistical texture analysis, texture features are computed from the statistical distribution of observed combinations of intensities at specified positions relative to each other in the image. According to the number of intensity points (pixels) in each combination, statistics are classified into first-order, second-order and higher-order statistics. The Gray

Level Coocurrence Matrix (GLCM) method is a way of extracting second order statistical texture features.

The approach has been used in a number of applications. Third and higher order textures consider the relationships among three or more pixels. These are theoretically possible but not commonly implemented due to calculation time and interpretation difficulty.

A GLCM is a matrix where the number of rows and columns is equal to the number of gray levels, G , in the image. The matrix element $P(i, j | \Delta x, \Delta y)$ is the relative frequency with which two pixels, separated by a pixel distance $(\Delta x, \Delta y)$, occur within a given neighborhood, one with intensity 'i' and the other with intensity 'j'. The matrix element $P(i, j | d, \theta)$ contains the second order statistical probability values for changes between gray levels 'i' and 'j' at a particular displacement distance d and at a particular angle (θ) . Using a large number of intensity levels G implies storing a lot of temporary data, i.e. a $G \times G$ matrix for each combination of $(\Delta x, \Delta y)$ or (d, θ) . Due to their large dimensionality, the GLCM's are very sensitive to the size of the texture samples on which they are estimated. Thus, the number of gray levels is often reduced. GLCM matrix formulation can be explained with the example illustrated in fig 2.1 for four different gray levels. Here one pixel offset is used (a reference pixel and its immediate neighbour). If the window is large enough, using a larger offset is possible. The top left cell will be filled with the number of times the combination 0,0 occurs, i.e. how many times within the image area a pixel with grey level 0 (neighbour pixel) falls to the right of another pixel with grey level 0(reference pixel).

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David Kirk



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Machine Intelligence for Research and Innovations Om Prakash Verma, Lipo Wang, Rajesh Kumar, Anupam Yadav, Ranjeet Kumar Rout, 2026-01-01 The book is a collection of high quality peer reviewed research papers presented in the Second International Conference on MACHine inTElligence for Research Innovations MAiTRI 2024 Summit held at National Institute of Technology Srinagar India during 21-23 June 2024 This book focuses on recent advancement in the theory and realization of machine intelligence MI and their tools and growing applications such as machine learning deep learning quantum machine learning real time computer vision pattern recognition natural language processing statistical modelling autonomous vehicles human interfaces computational intelligence and robotics

Intelligent Computing and Innovation on Data Science Sheng-Lung Peng, Le Hoang Son, G. Suseendran, D. Balaganesh, 2020-05-14 This book covers both basic and high level concepts relating to the intelligent computing paradigm and data sciences in the context of distributed computing big data data sciences high performance computing and Internet of Things It is becoming increasingly important to develop adaptive intelligent computing centric energy aware secure and privacy aware systems in high performance computing and IoT applications In this context the book

serves as a useful guide for industry practitioners and also offers beginners a comprehensive introduction to basic and advanced areas of intelligent computing Further it provides a platform for researchers engineers academics and industrial professionals around the globe to showcase their recent research concerning recent trends Presenting novel ideas and stimulating interesting discussions the book appeals to researchers and practitioners working in the field of information technology and computer science

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Data Science Gyanendra K. Verma,Badal Soni,Salah Bourennane,Alexandre C. B. Ramos,2021-08-19 This book targets an audience with a basic understanding of deep learning its architectures and its application in the multimedia domain Background in machine learning is helpful in exploring various aspects of deep learning Deep learning models have a major impact on multimedia research and raised the performance bar substantially in many of the standard evaluations Moreover new multi modal challenges are tackled which older systems would not have been able to handle However it is very difficult to comprehend let alone guide the process of learning in deep neural networks there is an air of uncertainty about exactly what and how these networks learn By the end of the book the readers will have an understanding of different deep learning approaches models pre trained models and familiarity with the implementation of various deep learning algorithms using various frameworks and libraries

Artificial Intelligence and Knowledge Processing Hemachandran K,Raul Villamarin Rodriguez,Manjeet Rege,Abejide Ade-Ibijola,Kok-Leong Ong,Vincenzo Piuri,2024-12-26 This book constitutes the 4th International Conference on Artificial Intelligence and Knowledge Processing AIKP 2024 held in Johannesburg Business School Johannesburg South Africa during August 22 24 2024 The 18 full papers included in this book were carefully reviewed and selected from 76 submissions This AIKP 2024 topics covered in these proceedings including machine learning natural language processing computer vision robotics data mining quantum AI and

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