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RESEARCH ARTICLE

A Computer-Aided Inspection System to Predict Quality Characteristics in Food Technology

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ABSTRACT Physicochemical and sensory analyses are commonly used to determine the quality characteristics of food samples in Food Industries. These methods are tedious, laborious, produce chemical residues, and involve the destruction of the samples. For the meat industries, this work proposes a non-invasive and non-destructive computer-aided inspection system, based on computer vision and ensemble machine learning techniques. The paper presents all the possibilities for the development of the system, making an exhaustive comparison of different algorithms used to extract features from the images of the samples, and various machine learning approaches, studying up to 6160 different models, and selecting the top 110 for the ensemble proposal. The system determines all the physicochemical, textural, and sensory quality characteristics of pork and beef loins in four meat states (fresh, thawed, cooked, and cured) with good precision, being a real alternative to the usual methods for the Food Industry.

INDEX TERMS Computer-aided system, feature extraction, loin, magnetic resonance imaging, quality parameters, regressor.

I. INTRODUCTION

Computer-Aided Inspection (CAI) has acquired great importance today, in different fields, such as mechanical and aerospace industry, textile industry, electrical and electronic industry... These systems have also generated interest in the food industry [1]–[4], mainly in the quality assurance step of the manufacturing process. The possibility of inspecting samples and predicting quality characteristics of the products, in a reliable and non-destructive way, is a great advance for the food industry.

The usual inspection techniques to determine quality parameters in meat industry are tedious, expensive, and involve the destruction of the samples by chemical substances. In addition, these techniques generate chemical waste that must be recycled.

Physicochemical analysis is one of the methods used to estimate quality characteristics [5]. This analysis determines the lipid and salt content, water activity and attributes related to the color of meat samples. Other analyses are related to meat textures, determining factors such as hardness, adhesiveness, stickiness, chewiness, etc. Besides, acceptance by consumers is related to sensory characteristics such as color, odor intensity, tenderness, juiciness, fibrousness... which are determined by expert tastings [6]. It is note that sensory analyses can produce subjective values. Through these three types of analysis (physicochemical, instrumental, and sensory) it is possible to create datasets with real values of the quality characteristics of meat products.

CAI system provides a new option for an automated, non-destructive and objective quality determination. The typical stages of CAI systems consist of an image acquisition procedure for food samples, the application of feature extraction algorithms on the images, and the evaluation algorithms. Systems based on hyperspectral imaging and machine learning

Computer Aided Techniques In Food Technology

Ensheng Dong

Computer Aided Techniques In Food Technology:

The book delves into Computer Aided Techniques In Food Technology. Computer Aided Techniques In Food Technology is a crucial topic that must be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Computer Aided Techniques In Food Technology, encompassing both the fundamentals and more intricate discussions.

1. This book is structured into several chapters, namely:

    ○ Chapter 1: Introduction to Computer Aided Techniques In Food Technology
    ○ Chapter 2: Essential Elements of Computer Aided Techniques In Food Technology
    ○ Chapter 3: Computer Aided Techniques In Food Technology in Everyday Life
    ○ Chapter 4: Computer Aided Techniques In Food Technology in Specific Contexts
    ○ Chapter 5: Conclusion

2. In chapter 1, this book will provide an overview of Computer Aided Techniques In Food Technology. The first chapter will explore what Computer Aided Techniques In Food Technology is, why Computer Aided Techniques In Food Technology is vital, and how to effectively learn about Computer Aided Techniques In Food Technology.
3. In chapter 2, this book will delve into the foundational concepts of Computer Aided Techniques In Food Technology. The second chapter will elucidate the essential principles that must be understood to grasp Computer Aided Techniques In Food Technology in its entirety.
4. In chapter 3, the author will examine the practical applications of Computer Aided Techniques In Food Technology in daily life. The third chapter will showcase real-world examples of how Computer Aided Techniques In Food Technology can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Computer Aided Techniques In Food Technology in specific contexts. The fourth chapter will explore how Computer Aided Techniques In Food Technology is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, this book will draw a conclusion about Computer Aided Techniques In Food Technology. The final chapter will summarize the key points that have been discussed throughout the book.
The book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Computer Aided Techniques In Food Technology.

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