International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Analysis of Human Emotions Based on Consuming Food Using CNN Approach

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Abstract
Food and emotions are correlated. Recent research on the relationship between foods and emotions mainly focused on identifying emotions when eating the food. We had different types of food and tastes respectively. Our project is to see the expressions of the person and identify that he/she was hunger or not. And later we want to calculate that he/she likes the food or not. And also which type of expressions that he/she was giving while eating the food that he/she likes the food or not.
After completing of his food which type of expressions he/she was giving either they were happy with that food or not. With this the restaurant owners will know if the food was good or not, If they like it then they will increase that food item to get more profit. If it was not good then it try to change the taste of that food item, even if it doesn't work then they remove that food item.

Keywords: Open CV, Python, Jupiter Notebook, Anaconda Navigator, Feedback System, Face Recognition, Emotion detection, Web Development, Database

1 Introduction

The basic resource of human being is food. A person can't even survive without eating food in their daily life. We had lot of food items. According to the busy schedule of our daily life we choose to eat some times in restaurants and also street food.
And we make them as our personal food place. So, in this way this makes the restaurant owners get profit by selling their food items. People will eat food and leave the place by not giving their feedback to the owners. This makes the owner not identify whether the item they eat was good or not. In the end of the day the restaurants are throwing huge amount of food in the garbage. To reduce this problem we had chosen this as our project that takes the image of the customer and identify which type of expression they are giving while eating. If the expression was good, then they will continue with that item recipe, otherwise they try to change the recipe. Even it doesn't work they change the item or delete the item to make it again in their restaurants. This makes them to reduce wasting of food.

1.2 Statement of the problem

The statement of the project is to study and analyse human emotions based on consuming food using a CNN (Convolutional Neural Network) approach. The project involves designing a model that can accurately predict human emotions based on facial expressions while consuming food. The project aims to collect a diverse dataset of images or videos of people consuming food, pre-process the data, design a CNN model architecture, train the model, evaluate the model's performance, and deploy the model as an application.

Objective

The objectives of the project are as follows:

To collect a diverse dataset of images or videos of people consuming food with annotations for the emotions expressed by the people in the images. To pre-process the dataset, including image resizing, cropping, normalization, and augmentation, to make the dataset more robust.

To design a CNN model architecture that can accurately analyse facial expressions of people while consuming food and predict their emotions. To train the CNN model using the pre-processed dataset and adjust the model weights to minimize the error between the predicted emotions and the actual emotions.

To evaluate the CNN model's accuracy and performance using a separate test dataset and assessment metrics such as accuracy, precision, recall, and F1-score.

- To analyse the relationship between human emotions and food consumption using the CNN model predictions.
- To provide insights into the relationship between food and human emotions, which could have implications in the healthcare and marketing industries.
- To deploy the CNN model as an application that can provide real-time analysis of human emotions based on facial expressions while consuming food.
- To explore the potential impact of the project beyond healthcare and marketing industries, such as in designing products that promote healthy eating habits or understanding cultural and societal norms on food consumption and human emotions.To contribute to the body of research on the relationship between food and human emotions, opening up avenues for further research in several domains.

1.4 Goals

To design a CNN model that accurately predicts human emotions based on facial expressions while consuming food.To create a diverse dataset of images or videos of people consuming food with annotations for the emotions expressed by the people in the images.To pre-process the dataset to make it more robust and suitable for training the CNN model.

1.5 Scope

The scope of this project is to develop a facial gesture-based system for physically challenged people to control a computer. The system will allow users to perform all mouse actions, such as monitoring the screen, scrolling, and cursor movement using their facial features.

The project will be divided into five phases: Image frame acquisition, Face tracking, Features extraction, Recognition of gestures, and Classification.

The project will involve capturing an image from a webcam and using facial recognition technology to identify and classify gestures. The end result will be a functional system that enables physically challenged people to control a computer through facial gestures.

1.6 Applications

A project on studying and analysing human emotions based on consuming food using a CNN approach has several potential applications. Here are some of them:

Personalized nutrition: One application of the project could be in the development of personalized nutrition plans that take into account a person's emotional response to food. By analyzing a person's emotions in real-time as they consume different types of food, the system could provide personalized recommendations on what to eat and how much to eat based on their emotional state.

Food marketing and advertising: The project could also have applications in food marketing and advertising. By analysing the emotional responses of consumers to different types of food, marketers

could develop more effective campaigns that resonate with their target audience.

Health and wellness: The project could also have implications for health and wellness. By understanding how different types of food affect a person's emotional state, healthcare professionals could develop more effective strategies for managing conditions such as obesity, binge eating disorder, and depression.

Product development: The project could also be used to inform the development of new food products that are designed to elicit specific emotional responses. By understanding the emotional impact of different flavours, textures, and aromas, food manufacturers could develop products that are more appealing to consumers.

Human-computer interaction: The project could also have applications in the development of intelligent systems that can recognize and respond to human emotions. By analysing a person's emotional response to food, these systems could adapt their behaviour to provide a more personalized and engaging user experience.

1.7 Limitations

Subjectivity of emotions: Emotions are subjective experiences that can vary from person to person, making it difficult to accurately measure and classify them. This can lead to biases in the data and the models, which can impact the validity and reliability of the results.

Diversity of food and cultures: Food is a complex and diverse cultural phenomenon that can vary widely across different regions and cultures. This can make it challenging to develop a comprehensive dataset that captures the full range of emotional responses to different types of food.

LITERATURE SURVEY

2.1 Collect Information

We have taken the information from the other sources like chatting apps, online sales apps and other online courses apps to check how they are categorized and organized and we proposed this ourselves.

2.2 Study

Based on our previous conversation, here are some key features of your proposed project

Facial Expression Recognition : This refers to the ability of a machine learning model to identify and classify human facial expressions. This can be used in a variety of applications, such as emotion detection in marketing or detecting signs of distress in healthcare settings.

Collection: This refers to the process of gathering data for the machine learning model. In the case of facial expression recognition, this could involve collecting images or videos of human faces expressing different emotions.

Performance Evaluation: This refers to the process of assessing the accuracy and effectiveness of the machine learning model. This can involve testing the model on a separate dataset to see how well it performs in identifying facial expressions.

Business Application: This refers to the practical use of the machine learning model in a business setting. For example, a company may use facial expression recognition to analyse customer reactions to a new product or service.

Pre-processing : This refers to the process of preparing data for use in a machine learning model. In the case of facial expression recognition, this could involve cropping and resizing images, converting them to grayscale, or normalizing the lighting conditions.

2.3 Benefits

The study and analysis of human emotions based on consuming food using a CNN (Convolutional Neural Network) approach can have several benefits. Some of the potential benefits include:

Understanding the relationship between food and emotions: Food and emotions are closely linked, and analysing how different foods can affect emotions can help us better understand the relationship between them. This can be beneficial for individuals looking to manage their emotional eating habits, as well as for food companies looking to develop products that evoke positive emotions in consumers.

Identifying emotional triggers: By analysing the emotions associated with different types of food, a CNN approach can help identify emotional triggers that lead to certain eating behaviours. This can be useful for individuals looking to break unhealthy eating habits and develop more mindful eating practices.

Personalized nutrition: Understanding how different foods affect emotions can help create personalized nutrition plans for individuals based on their emotional responses to food. This can lead to more effective weight management strategies and better overall health outcomes.

Improved marketing strategies: Food companies can use the results of the study to develop better marketing strategies that target specific emotions associated with their products. For example, a company that sells comfort foods could use the study's findings to create marketing campaigns that emphasize the emotional benefits of their products.

Better mental health outcomes: Understanding the relationship between food and emotions can help improve mental health outcomes, as it can help individuals identify the foods that trigger negative emotions and avoid them. Additionally, developing more positive emotional responses to food can lead to improved mental health outcomes and a better overall quality of life.

Summary

In our system we build an application and website with all these features of job opportunities, products sales, chatting purpose, notifications and news feed at all in one place that is Frendzit.com.

3.1 Existing system

(Social networking sites)

In Existing system there are apps to chat to with friends and family, can video calls audio calls in that. Apart from these type of chatting apps there are apps for jobs and internships for the people who are looking for opportunity.Many online courses apps are also there.

3.2 Disadvantages

Sure, here are some disadvantages associated with facial expression recognition technology:

Privacy : Facial expression recognition technology can raise privacy concerns, as it involves capturing and analyzing people's facial features without their consent. This can be especially problematic if the technology is used for surveillance purposes or if the data is mishandled or used for unintended purposes.

Cost : Developing and implementing facial expression recognition technology can be expensive, as it requires significant investment in hardware, software, and personnel. Additionally, ongoing maintenance and updates may also be costly.

Ethical considerations : Facial expression recognition technology raises several ethical considerations, such as the potential for bias, discrimination, and misuse. For example, if the technology is not properly designed and tested, it may be more accurate in recognizing certain facial expressions or demographics, which could lead to unfair treatment.

Accuracy : Facial expression recognition technology may not always be accurate, as it relies on complex algorithms that are trained on large datasets. However, these algorithms may not always generalize well to new data, and there may be errors or biases in the training data that impact the accuracy of the technology.

3.3 Proposed System

Facial expression recognition system : This system would use a CNN model trained on a dataset of facial expressions related to food consumption to identify and classify emotions such as enjoyment, disgust, or indifference. The system wouldd ata from customers as they consume food, providing real-time feedback on their emotional responses.

Customer feedback system : This system would integrate the facial expression recognition technology with a feedback mechanism, allowing customers to rate their food based on their emotional response. For example, the system could display a series of emojis or sliders representing different emotions, allowing customers to select their preferred response.

Analytics and reporting system : This system would collect and analyze data on customer emotions related to food consumption, providing insights into which food items are popular and which ones need improvement. The system could generate reports and visualizations that show trends over time, allowing restaurant owners to make data- driven decisions about their menu and marketing strategies.

Menu optimization system : This system would use the data collected from the facial expression recognition technology to optimize the restaurant's menu, making changes based on customer preferences and emotional responses. For example, the system could recommend new dishes or ingredients based on their popularity or adjust the pricing based on their emotional response.

Integration with other systems : The proposed system could be integrated with other technologies or systems, such as online ordering or reservation systems, loyalty programs, or social media platforms. This could provide a more comprehensive view of customer preferences and behavior, allowing restaurant owners to improve their overall customer experience.

3.4 Advantages

There are several advantages of your proposed project, including:

Improved customer experience : The facial expression recognition technology could provide real-time feedback on customer emotional responses to food, allowing restaurant owners to adjust their menu or service to better meet customer needs and preferences. This could lead to a more enjoyable and satisfying dining experience for customers.

Data-driven decision-making : The analytics and reporting system could provide valuable insights into customer preferences and behavior, allowing restaurant owners to make data-driven decisions about their menu, marketing, and pricing strategies. This could lead to more effective and efficient use of resources and increased profitability.

Innovation and differentiation : The use of facial expression recognition technology in the context of food consumption is a novel and innovative approach that could differentiate the restaurant from competitors and attract new customers. This could increase the restaurant's visibility and reputation and lead to greater customer loyalty.

Potential for scalability : Once the facial expression recognition system is developed and implemented, it could be scaled up to other restaurants or food service establishments. This could provide a new revenue stream for the business and increase the reach and impact of the technology.

Potential for social impact : Your proposed system has the potential to be used in other domains

beyond the restaurant industry, such as food research or public health initiatives. By analyzing the relationship between food and emotions, the technology could contribute to a better understanding of human behavior and well-being, potentially leading to improvements in public health and nutrition policies.

3.5 System Requirements

Software Requirements:

Python programming language

Deep learning libraries such as TensorFlow, Keras, or PyTorch for implementing the CNN model OpenCV library for processing and analyzing facial data

Flask or Django web framework for building the user interface and integrating the different systems SQL database to store and manage customer data and feedback

Hardware Requirements:

Computer with a minimum of 4GB RAM and a 64- bit processor

Webcam or other camera to capture facial data High-speed internet connection to facilitate data processing and analysis

SYSTEM DESIGN

4.1 DESIGN OF THE SYSTEM

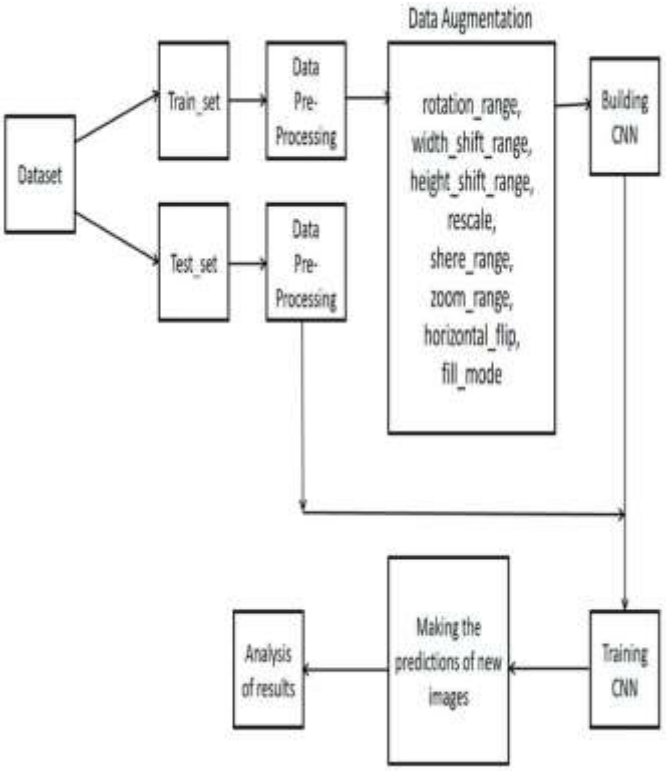
Unified Modelling Language (UML) was created in 1995 by using merging diagramming conventions used by three application development methodologies: OMT by James Rumbaugh, Objector y by Invar Jacobson and the Brooch procedure by using Grady Brooch. Previous to this time, these three amigos, together with a few dozen other practitioners had promoted competing methodologies for systematic program development, each and every with its prossess system of diagramming conventions. The methodologies adopted a sort of cookbook sort of pushing a application task via a succession of life cycle stages, culminating with a delivered and documented software. One purpose of UML was once to slash the proliferation of diagramming techniques by way of standardizing on a original modelling language, as a result facilitating verbal exchange between builders. It performed that goal in 1997 when the (international) Object administration team (OMG) adopted it as a commonplace. Some critics don't forget that UML is a bloated diagramming language written by means of a committee. That said, I do not forget it to be the nice manner to be had today for documenting object-oriented program progress. It has been and is fitting more and more utilized in industry and academia. Rational Rose is a pc Aided program Engineering (CASE) software developed by way of the Rational organization underneath the course of Brooch, Jacobson and Rumbaugh to support application progress using UML. Rational Rose is always complex due to its mission of wholly supporting UML. Furthermore, Rational Rose has countless language extensions to Ada, C++, VB, Java, J2EE, and many others. Rational Rose supports ahead and reverse engineering to and from these langueages. However, Rational Rose does not aid some usual design tactics as knowledge drift diagrams and CRC cards, due to the fact that these will not be a part of UML. Considering that Rational Rose has so many capabilities it is a daunting task to master it.

Happily, loads can be executed making use of only a small subset of these capabilities. These notes are designed to introduce beginner builders into making productive use of the sort of subset.

4.1.1 Class diagram:

Class diagram in the Unified Modelling Language (UML), is a kind of static structure diagram hat describes the constitution of a process through showing the system's classes, their attributes, and the

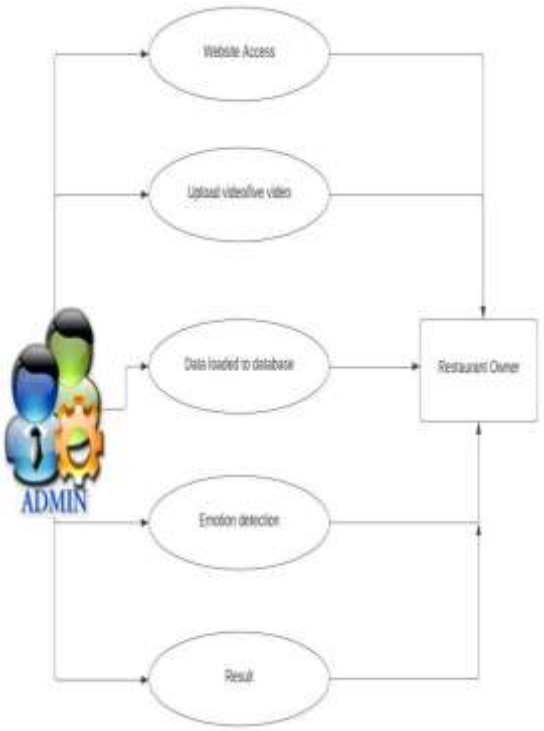
relationships between the class. The motive of a class diagram is to depict the classes within a model. In an object-oriented software, classes have attributes (member variables), operations (member capabilities) and relation



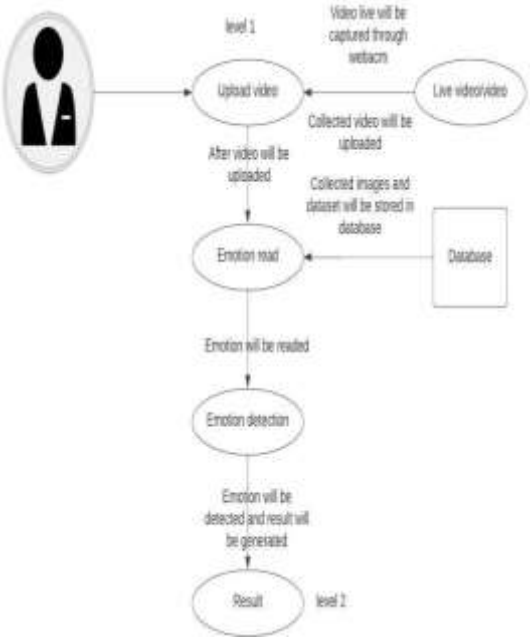
4.1.2 UseCase Diagram:

It is a visually representation what happens when actor interacts with system. A use case diagram captures the functional aspects of a system. The system is shown as a rectangle with name of the system inside ,the actor are shown as stick figures, the use case are shown as solid bordered ovals labeled with name of the use case and relationships are lines or arrows between actor and use cases.

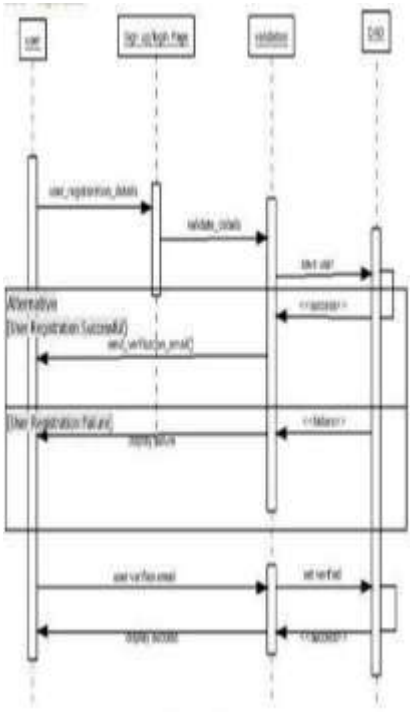
Symbols used in Use case are as follows



SEQUENCE DIAGRAM



A sequence diagram in Unified Modelling Language (UML) is one variety of interaction diagram that suggests how methods operate with one other and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are quite often referred to as event-hint diagrams, event situations, and timing diagrams. A sequence diagram suggests, as parallel vertical traces (lifelines), special systems or objects that are residing at the same time, and, as horizontal arrows, the messages exchanged between them, within the order the place they occur.

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Conclusion

In conclusion, the proposed project aims to use facial expression recognition technology and deep learning algorithms to analyze customer emotions and feedback during food consumption in a restaurant setting. The system would provide valuable insights into customer preferences and behavior, allowing restaurant owners to make data- driven decisions about their menu, marketing, and pricing strategies. Additionally, the technology could contribute to a better understanding of the relationship between food and emotions, potentially leading to improvements in public health and nutrition policies. While there are some challenges and limitations associated with this project, the potential benefits, such as improved customer

Video Technology

experience, innovation and differentiation, and potential for scalability and social impact, make it a promising area for future research and development.

Future Enhancement

In addition to facial expression recognition, you could also incorporate other modalities such as voice recognition, body language, or physiological signals such as heart rate or skin conductance. This could provide a more comprehensive analysis of customer emotions and feedback. The system could be customized for individual customers based on their previous dining experiences and feedback.

This could allow for more personalized recommendations and better customer satisfaction.

The system could be integrated with the kitchen ordering and inventory systems, allowing for real- time adjustments to the menu based on customer feedback. This could improve the efficiency of the restaurant and provide better menu options for customers. The system could be applied to other domains beyond the restaurant industry, such as food research, product development, or public health initiatives. This could provide new insights into the relationship between food and emotions and lead to innovations in other industries.

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