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Survey on Food Adulteration for Toor Daal

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Abstract: Food adulteration is a serious issue plaguing the health and safety of many individuals. It is the process of deliberately changing, adding, or removing a food ingredient without the consumer being aware, thus altering the nutritional value of the product. It can occur on purpose or inadvertently due to poor hygiene, and can greatly increase the likelihood of serious illnesses such as food poisoning and more.

Furthermore, food adulteration can occur through the use of substandard ingredients. For example, many food manufacturers are known to use lower quality ingredients in order to cut costs, leading to compromised nutritional values and taste.

Though food adulteration can be difficult to detect, there are some telltale signs of adulterated food. Food that has been adulterated may smell strange or have an unusual taste, colour, or texture. Additionally, food labels should alert consumers to the presence of unhealthy additives, expired ingredients, and other dangerous components.

In conclusion, food adulteration is a serious issue that affects both the health and safety of individuals as well as the quality of food products. While it can be difficult to detect, understanding the signs of adulteration can help consumers stay aware and make healthy choices when purchasing food items.

Keywords: Daal, adulteration, colour and size data, sorting, image pixels.

I. INTRODUCTION

From the Great Olden Ages, the population of India residing mostly in the rural areas and urban cities, consume a lot of food grains on a daily basis. There are around 26 types of food grains (06 cereals, 08 millets and 12 pulses) consumed in India. For the maintenance of human health, the grains we consume should be unadulterated, pure and nourishing. Any grain substance consumed is done so for the purpose of gaining sustenance. The nourishment in the grain items is deflated since it goes through a series of production, processing, and distribution steps. The quality of the sold grains has greatly reduced by the various unethical and illegal practices of adding adulterants to these food grains in order to increase the supply. An adulterant is a foreign substance added to the existing food grains.

Adding an adulterant causes problem to a human body when consumed. In the process of adulteration, minute quantities of the foreign non-nutritious substances are added knowingly in order to improve its appearance, number and storage properties of the group. It is observed that the bag of Toor Daal is adulterated with Khesari Daal. In terms of grain production, India comes in second place to China. In India, all pre- and post-harvest procedures are carried out manually with the assistance of skilled or unskilled labour. Because of these manual processes take a long time and are inefficient, automation is required in the agriculture sector to produce precise results. Sorting and grading of grains are steps in the post-harvest process.

Toor daal, commonly known as Arhar daal, is a staple diet among Indian households. It is a good source of minerals, vitamins and dietary fibers and is considered a wholesome food with rich nutritional density. Due to its nutritional value, Toor daal is frequently used in a number of food products such as soups, gravies, snacks, etc. As a result, it has become increasingly vulnerable to adulteration. Moreover, a variety of synthetic dyes are also used for adulteration. These dyes can range from food grade dyes to industrial dyes which have not been approved by food safety regulatory boards. The consumption of such dyes can be detrimental to health as they can lead to severe food allergies and can also cause neurological and gastrointestinal disorders.

Similarly, adding wheat and barley grains in the toor daal can pose the risk of denaturing proteins in the daal, causing health issues such as allergy, indigestion and other gastrointestinal problems. Considering the potential hazards, it is

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important for consumers to be aware of the issue of food adulteration. Accurate food labelling is necessary to discriminate between adulterated and unadulterated food products. Furthermore, food safety authorities should also take strict action against the companies selling adulterated food items. The public must be made aware of the effects of food adulteration and join hands in curbing this practice. Doing so will go a long way in ensuring the health and safety of consumers.

II. LITERATURE REVIEW

Mr N. Vishal in [1] proposes Machine learning techniques in the development of an IoT-based food and formalin detection tool. The block diagram for fruit adulteration detection is shown in the image below. Formaldehyde mixing with Raspberry-Pi is detected using Grove HCHO, a semiconductor VOC (Volatile Organic Compound) sensor This sensor can identify gases at concentrations up to 1 ppm (parts per million). Since formaldehyde is a self-vaporizing solution, a volatile organic chemical sensor can detect its presence. The sensor's output voltage is exponentially correlated to the amount of formalin in the fruit sample. As each fruit has a variable range of resistance, different voltage drops are observed for different fruit samples after the formalin detection. First, they constructed the rule-based classification model [set of IF-THEN rules], which first categorises the fruit type, using the collected features from the data set. Later, they classified using different algorithms, and the outcomes were evaluated. They constructed this model and trained it using a dataset that also shows the naturally added ppm (parts per million) value along with the additionally added formalin, fully taking into account the naturally present formalin in fruits. This system produces the output by predicting whether a specific fruit item is "safe" or "hazardous." Drawback: The formalin detection requires pricey hardware components.

[2] Headspace-gas chromatography-ion mobility spectrometry (HGC-IMS) is used to detect the volatile flavour components of five different types of rice in order to effectively identify the quality of rice and adulterated rice. This method addresses issues with traditional biochemical methods, such as difficult sample pretreatment requirements, laborious detection processes, and low detection accuracies with respect to rice species and adulteration. A semi-supervised generative adversarial network is used to identify the ion migration fingerprint spectra of five different types of rice (SSGAN). We convert a GAN into a semi-supervised GAN by substituting a soft-max classifier for the output layer of the discriminator. To direct the training process, we define extra category tags for created examples. The network parameters are optimised via semi-supervised training, and the trained discriminant network is then utilised to categorise HGC-IMS images.

The results of the experiments reveal that the model's prediction accuracy is 98.00%, which is significantly higher than the rates attained by other models, including decision trees, support vector machines (SVM), improved SVM models (LSSVM and PCA-SVM), and local geometric structure Fisher analyses (LGSFA). 98.00% is also higher than the prediction accuracies of the VGGNet, ResNet, and Fast RCNN deep learning models. Drawback If the lighting in the testing venues differs, the prediction is ineffective, and the colour characteristic adulteration is discovered. (together with the increased formalin amount (parts per million). This system produces the output by predicting whether a specific fruit item is "safe" or "hazardous."

[3] For humans to survive, they must have access to food. Food has long been seen as a vital need for people in order to both sustain health and treat illness. For humans to efficiently survive, they require a large quantity of nutrients and fibers from the food they eat on a daily basis which constitutes to a healthy diet helping them sustain a long life. It is one of the most fundamental needs that both man and all other living things have, as it is with all living things. An incredibly low-cost, reliable, and biocompatible impedance sensor that functions as a fractional-order element has reportedly been developed and might be used to distinguish between milk and tainted milk, according to a recent paper. More than 160 scholarly articles are included in a thorough investigation of milk adulteration.

The purpose of this research is to identify numerous milk adulterants, various methods for detecting each type of adulterant, and the health risks related to milk product adulteration. The fractional-order element would be looked into in the project proposal in order to see if it might be used to identify adulterated milk. This fractional-order element-based impedance sensor is particularly helpful in the detection and separation of fake and real milk because it can distinguish between various forms of contaminated milk and various types of fake milk. The researchers claim to have developed an inexpensive, user-friendly instrumentation system for identifying adulterated milk. They intend to market it soon. In order to decrease the need for specialised labour and increase productivity, a microcontroller-based automated sensing system for the identification of synthetic milk has been developed. The impedance sensor must be modelled while taking into account the dipole layer capacitance at the interface of the contaminated milk and the immersed impedance sensor. Drawback: Since the dataset in this study only contains static images, k means clustering is unable to handle noisy data and outliers, which results in less accurate results.

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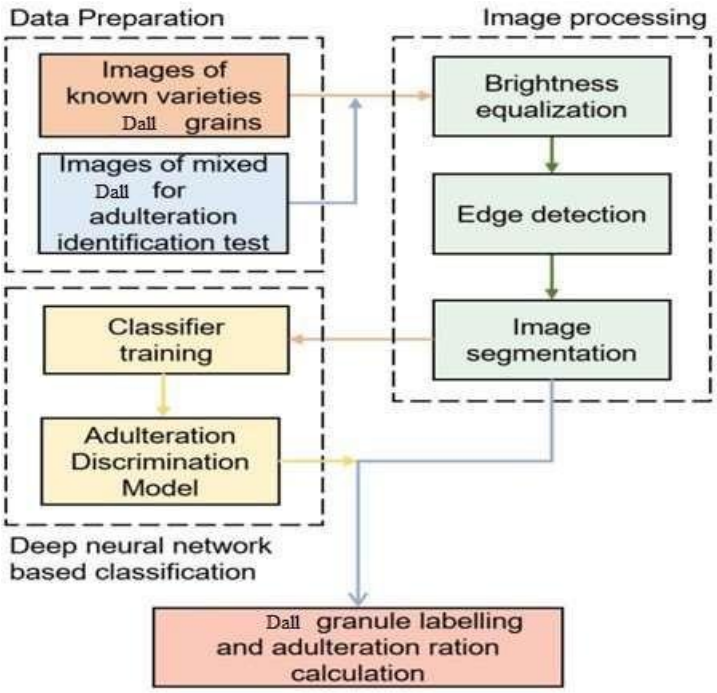
[4] India's largest industry is the fruit industry. Due to improper human inspection and a lack of care, the fruit disease significantly reduces yield, quality, and quantity. The manual inspection process is laborious and time-consuming. The identification and classification of apple fruit diseases using various combinations of colour, texture, and shape features is offered as an image processing approach. The fundamental steps of the suggested method include image segmentation, feature extraction (colour, texture, and form), feature combining, and lastly, the identification and classification of apple disease using a multi-class support vector machine into classes that are diseased or normal. Our suggested method was empirically confirmed and approved. Up to 96% accuracy is attained using the suggested approach. Drawback: The SVM gives lesser accuracy than CNN.

Sl No.	Title of the Paper	Author	Journal & Publication Year of Paper	Methodology	Outcome
[1]	Detection of Adulteration of Fruits using IOT	Prince Sahaya Brighty; G. Shri Harini; N. Vishal	IEEE March 2021	Machine learning techniques are used.	Develops of an IoT-based food and formalin detection tool.
[2]	Identification of Rice Varieties and Adulteration using Gas Chromatography-Ion Mobility Spectrometry	Xingang Ju; Feiyu Lian; Hongyi Ge; Yuying Jiang; Yuan Zhang; Degang Xu	IEEE January 2021	Headspace-gas chromatography-ion mobility spectrometry (HGC-IMS) is used.	To identify the ion migration fingerprint spectra of five different types of rice (SSGAN).
[3]	Detection of Adulteration in Food Using Recurrent Neural Network with Internet of Things	Vishwesh Nagamalla, Muthu Kumar, Neha Janu, Anusha Preetham, Syam Machinathu	Hindawi April 2022	Fractional-order element-based impedance sensor is used.	To identify numerous milk adulterants, health risks related to milk product adulteration.
[4]	Fruit disease Classification and Identification using Image Processing	Shaikh Rakhshinda Nahid M. Ayyub, Aarti Manjramkar	IEEE August 2019	Image segmentation, feature extraction, feature combining.	Up to 96% accuracy is attained using the suggested approach.



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III. CONCLUSION

The adulterant recognition algorithm model and a light version of toor daal are suggested in this research. This model has a maximum classification accuracy of 85.12%. The model put forward in this paper performs better at recognition than other lightweight networks. YOLO v7 will be used to further raise the proportion of matching. The accuracy of the model presented in this research differs slightly from other depth models, and there are fewer parameters and computations. According to the analysis of the previously proposed experiments, the enhancements suggested in this study can increase the model's classification accuracy and generalisation capacity. Future work on this research will focus on:

[1] Implementing the model on embedded devices to enable real-time monitoring in automated operations.

[2] Developing big datasets using additional daal grain sample data.

[3] Simplifying and streamlining the daal picture for image extraction.

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