Seed Quality Detection

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Abstract: - Every grower at some point has observed the effects of poor seed quality: slow germination, damping-off, poor standards, and mixed or genetically contaminated lots. Determining the seed quality, that is, their suitability for planting is very important for good quality crop. Seeds are quite small in sizes and are difficult to differentiate based on their color and size. Human testing procedures have their limitations, like most of these are time consuming, labor intensive and sometimes the results are not reproducible in actual field conditions. The seeds we intake in daily life is important part of the diet and we must ensure the quality of seeds to ensure the nutrient ratio. This is a major issue while we buy them from online stores, and this may also affect our health also. Using this tool, a good quality of seed can be determined easily. Image analysis is a state-of-the-art technique for seed quality testing. This tool provides vast usage in evaluation of various physiological and morphological characteristics of the seed with a more comprehensive perception. It is based on the extraction of numerical data from a captured image for characteristics like color, size, shape of seed and seedlings and their subsequent processing with the help of suitable computer software.

I. Introduction

Application which is used for detection of seed quality and classify them accordingly in real time. To provide a platform for Industries and local/small business for better classification of different seeds. This classified data can be further used for research and analysis which can result in good crop harvest and yield. This application can also be used to verify quality of rice, pulses, wheat, etc. in an e-commerce shopping**.**

II. Problem Formulation

Application/platform which will be able to detect the seed quality and classify them accordingly in real time. This tool can be used by the industries to classify seeds and their quality, this can also be used by the local/small businesses and can also be used by the ecommerce website to show the quality for the pulses they are selling online. This tool will also collect the seed quality data and show the graphical representation for the data according to the seed, quality and various other aspects and will analyze it.

PRELIMINERY INVESTIGATION

- Current Systems

All the current systems that are available do not provide all the features in one application along with supporting requirements. In an application named as LUCIA 3.52 software package, they only analyses Flax, Lenti seeds. Also, in Delta-T© (winDIAS), they Only analyses Mustard, Oat.

LIMITATIONS OF CURRENT SYSTEMS

- UI is not user friendly of many applications.
- Accurate results are not present.
- Doesn't have user friendly process.
- Analysis of previous and current data is not there.
- Delivers analysis for only few seeds.

S. No.	Company Name	Pros	Cons
1	LUCIA 3.52 software package	Large availability	Only analyses Flax, Lentil
2	Delta-T© (winDIAS)	Large availability	Only analyses Mustard, Oat
3	ImageJ software	Medium availability	Old quality detection strategy
4	Seed Vigor Imaging System	Medium availability	Old quality detection strategy
5	Matrox image processing board	Large availability	Only provide analysis for Lettuce, Sorghum

III. Methodology

The methodology of Seed Quality Detection is based on the technical aspects of the application are:

a) Deep Learning:

Deep Learning is a subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks. Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. Learning can be supervised, semi-supervised or unsupervised. Deep learning models are loosely related to information processing and communication patterns in a biological nervous system, such as neural coding that attempts to define a relationship between various stimuli and associated neuronal responses in the brain.

b) Neural Networks:

In machine learning, a convolutional neural network (CNN, or Convolutional Neural Network) is a class of deep, feed-forward artificial neural networks that has successfully been applied to analyzing visual imagery. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand-engineered.

c) TensorFlow:

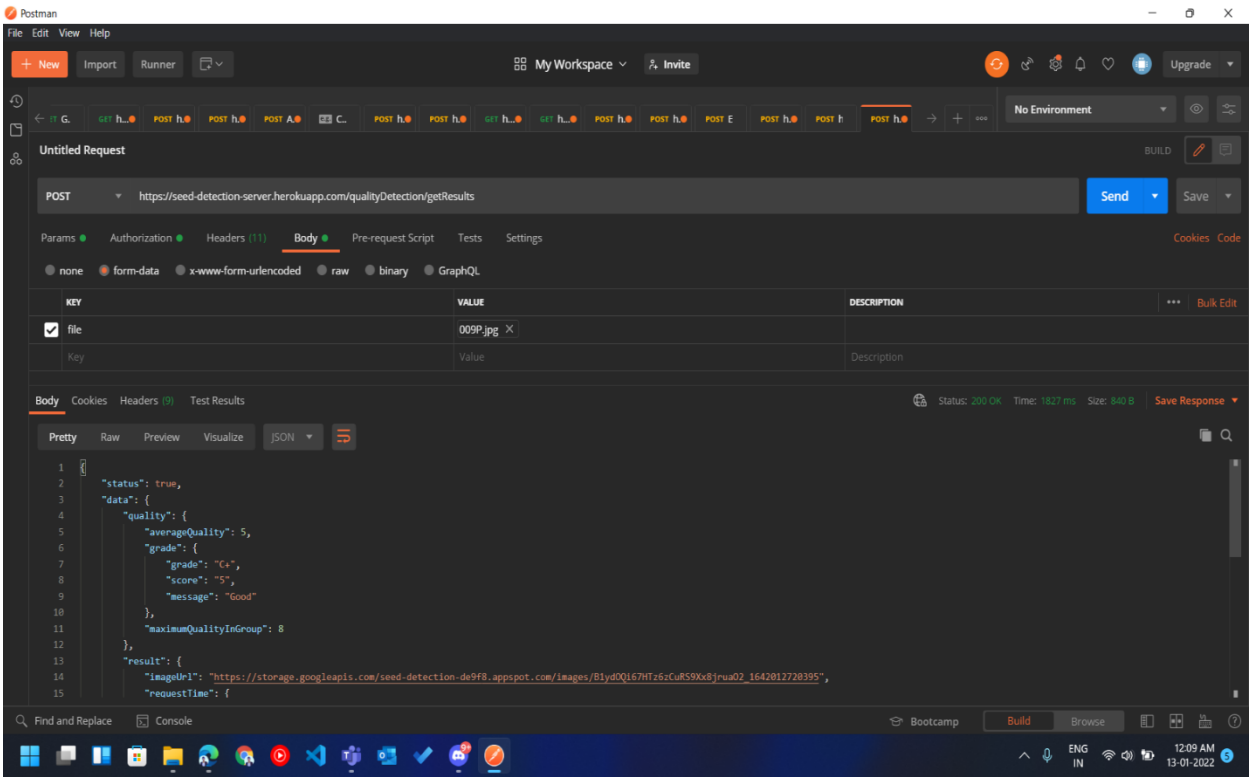
TensorFlow is an open-source software library for high performance numerical computation. Its flexible architecture allows easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices. TensorFlow allows developers to create dataflow graphs—structures that describe how data moves through a graph, or a series of processing nodes. Each node in the graph represents a mathematical operation, and each connection or edge between nodes is a multidimensional data array, or tensor.

d) OpenCV:

OpenCV (Open-Source Computer Vision Library) is released under a BSD license and hence it's free for both academic and commercial use. It has C++, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS, and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multicore processing. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform

IV. Result Discussions

The aim of the project, Seed Quality Detection is to detect, identify and analyze the quality of seeds and save their details in the database is successfully and accurately done by this project with the use of concepts like Deep learning, Convolutional Neural Networks, OpenCV and TensorFlow. The work done manually can now be completely replaced by this automated system and it can reduce all the extra efforts of maintain the records.



REST API call with API limit

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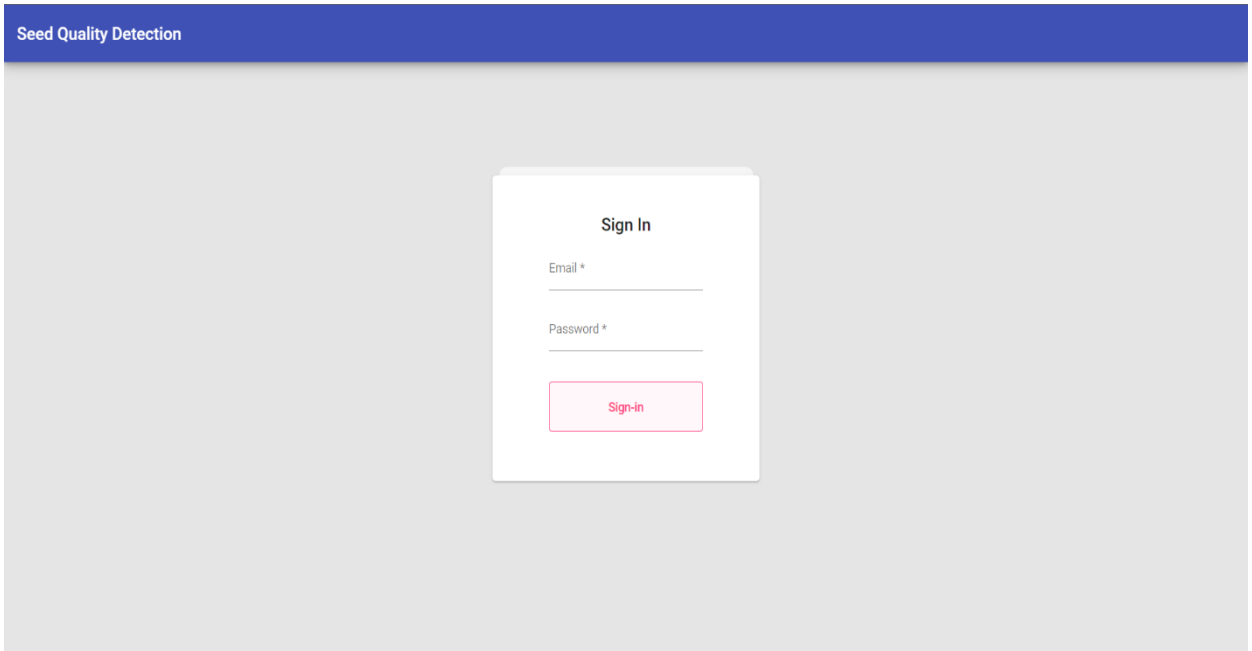

Login Page

Dashboard

LIMITATIONS OF THE WORK

The working of this project would be a little slow because framework like TensorFlow, & deep learning need high-processing hardware and GPU (graphical processing unit) systems, but we are using CPU only. The models that we are using for identifying the objects are pre-trained models. So, if we want to train our own model, it takes a lot of time and processing. In the system, scanning of each frame is one per second but still it needs improvement. If the objects move too fast, it may not detect them.

V. References

- Date set for training and testing the model https://github.com/dhishku/MachineLearning-forGrain-Assaying/blob/master/Dataset_Wheat_Grain.md
- YOLO: Real-Time Object Detection (pjreddie.com)
- https://github.com/ModelDepot/tfjs-yolo-tiny
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