Project Report

On

Cotton Quality Detection System using Machine Learning Techniques

Submitted for partial fulfillment of requirement for the degree of

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Submitted By

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CERTIFICATE

This is to certify that the Project (8KS07) entitled

Cotton Quality Detection System using Machine Learning Techniques

is a bonafide work and it is submitted to the

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in the partial fulfillment of the requirement for the degree of ***Bachelor of Engineering*** *in* ***Computer Science & Engineering****, during the academic year* ***2021-2022*** *under my guidance.*

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ABSTRACT

Raw cotton is used for Ginning Industries to form fibers in the form of cotton bales. For ginning industries at present quality at the time of purchase is checked manually and it is very difficult and problem creating task for industry owner as well as for farmers. Quality plays vital role for ginning industry. So, it will be better to have scientific identification of qualities. Basic idea in the project is to identify the quality of cotton by using knowledge of computer, which help to identify quality in cotton industries. Support vector Machine (SVM) is applied on raw cotton it will be better for the industries to finalize the purchase value& use of finished product in the market etc.

Cotton quality characteristics are increasingly measured by instruments rather than manually. Increased competition in the industry, consumer demand for a wider range of products, and more stringent standards for product use have prompted more intensive fiber quality examination. Over 92 percent of textile firms surveyed own one or more fiber testing instruments. Ninety percent own instruments for testing fineness and maturity, 70 percent for measuring length and length uniformity, and 60 percent for determining fiber strength. This report presents information on the determination and use of cotton quality measures, and the development of high-volume instrument testing systems.

Keywords- Raw cotton fibers, color assessment, classification, SVM.

CHAPTER 1
INTRODUCTION

1.1 Overview:

Knowledge of cotton quality is a necessary component of an efficient marketing system. Because cotton exhibits such wide variation in fiber properties among samples, effective description and measurements of these properties are essential. The use of quality information by textile mills enables management to develop optimum blending levels which reflect the best combination of fiber properties required for each end-use. For cotton producers, premiums paid for qualities most in demand and discounts for undesirable qualities provide an incentive to growers to produce those qualities that have the highest values to manufacturers and consumers of textile products. Official USDA cotton quality classifications measure three factors: grade, staple, and micronaire.

1) Grade depends on the color, trash content, and preparation (smoothness) of the sample.
2) Staple is the average length of the individual fibers.
3) Micronaire is a measure of fiber fineness and maturity.

However, other fiber properties are also recognized as being important and are increasingly being measured by instrument testing. This report traces the development of cotton quality testing; provides a description of the measurable fiber properties and how they relate to processing performance; and presents the results of a survey of textile mills to determine current use of quality information and the extent of instrument testing of cotton for quality determination. The quality of cotton is evaluated in terms of length of the fiber, count, weight, and tensile strength. After harvesting raw cotton is ginned and prepared for yarn spinning. High-quality cotton can produce high-quality yarn, fabric, and therefore high-quality cloths. Technology has large impact on agriculture productivity. Whether it is mechanical or computer technology, both have large application in agriculture. It can be used from plantation of crop to harvesting of crop.

1.2 Motivation:

Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality. Digital image process is the use of computer algorithm to perform image process on digital pictures. It permits various algorithms to be applied to the computer file and might avoid issues like the build-up of noise and signal distortion throughout process. Digital image process has important role in agriculture sector. From crop diseases detection to crop fruit detection, image processing has various applications in farming field. One emerging application of it is to detect mature fruit by means of fruit harvesting in farm. Cotton harvesting robot is one example of it. Image processing technique can be used to detect cotton flower on plant which can be harvest by machine rather than human. Various image segmentation techniques can be used to detect cotton flower in image. Image segmentation is the techniques are used to partition an image into meaningful parts have similar features and properties. Segmentation gives simplification i.e., representing an image into meaningful and easily analyzable way. The main goal of image segmentation is to divide an image into several parts or segments having similar features. Parameters like illumination level, stem and leaf of plant, different camera angle have impact on cotton detection process. As this operation is in open environment is face most of problem from sun illumination level. Open environment gives challenge to detection process as camera can also capture background behind cotton plant. Image processing technique need to differentiate between stem, leaves and cotton flower. Figure-1 shows captured images of cotton flower in field. From images, it is observed that cotton flower does not have defined shape so it is difficult to apply pattern recognition for detection of cotton flower. Also, different illumination level can be seen in captured images. Some image captured with high sun light while other are captured at low sun light. Thus, we come to know that the field of computer science and engineering is useful for enhancement of the Cotton Quality Detection and will provide the ease in identification of Cotton Grade for the end users and also use to for social cause.

1.3 Problem Definition:

From a textile processing point of view, fiber quality is very important because many fiber properties are strongly correlated with the properties of finished yarns and fabrics and the ease with which these finished products are manufactured. For example, the strength of fibers largely determines the strength of yarns, while the maturity of fibers determines the dye uptake property of fabrics. Raw cotton with unfavorable fiber quality causes problems (such as excessive yarn breaks) in the textile mill, and sometimes the problems are so severe that equipment must be brought to a complete halt. Due to the importance of raw cotton fiber quality to the textile industry, the USDA – AMS (Agricultural Marketing Service) requires that all cotton bales in the government loan program be classed before entering the trading market; and the loan value of a bale of cotton is determined by its bulk fiber quality. Thus, samples are pulled from each bale and sent to a classing office for analysis. To date, the in-field variability of fiber quality has been mainly determined by collecting cotton samples manually from various locations in the field and summarizing the data in terms of descriptive statistics such as the standard deviation and coefficient of variation.

1.4 Aim and Objectives:

Aim of the dissertation is to predict the quality of raw cotton to give perfect pricing for both farmers and provide best quality of raw material for textile industries in India or outside India, with the help of machine learning approach.

Objectives: -

A. To design a mechanism which will provide a way towards identifying cotton quality. (Is This objective fulfilled?)
B. To provide a method which will automatically sort good quality and bad quality cotton without any human intervention. (Is This objective fulfilled?)
C. To provide cost effective solution to various textile industries which are working in cotton fiber processing. (Is This objective fulfilled?)

CHAPTER 2
LITERATURE SURVEY

2.1 Related Work

Knowledge of cotton quality is a necessary component of an efficient marketing system. Because cotton exhibits such wide variation in fiber properties among samples, effective description and measurements of these properties are essential.

The use of quality information by textile mills enables management to develop optimum blending levels which reflect the best combination of fiber properties required for each end-use. For cotton producers, premiums paid for qualities most in demand and discounts for undesirable qualities provide an incentive to growers to produce those qualities that have the highest values to manufacturers and consumers of textile products.

Official USDA cotton quality classifications measure three factors: grade, staple, and micronaire [10]. [1] Grade depends on the color, trash content, and preparation (smoothness) of the sample. Staple is the average length of the individual fibers. Micronaire is a measure of fiber fineness and maturity. However, other fiber properties are also recognized as being important and are increasingly being measured by instrument testing.

This report traces the development of cotton quality testing; provides a description of the measurable fiber properties and how they relate to processing performance; and presents the results of a survey of textile mills to determine current use of quality information and the extent of instrument testing of cotton for quality determination.

Development of Cotton Quality Testings

Grade and staple have been factors in quality determination of cotton for a long time; micronaire became part of the official classification system during the sixties. Other factors, such as fiber strength and length uniformity, have also been used to evaluate cotton quality. These other factors, together with micronaire, determine the character of the cotton.

Changing Needs for Cotton Testings

Cotton has been used in textile manufacturing for thousands of Cotton Testing years. Over time, manufacturers came to realize some qualities of cotton behaved much differently from others during the manufacturing process; disparities in performance ultimately led to systems of describing cotton quality. Cotton grading apparently began in Liverpool, England, about 1800 (5). The grading system, which assigned names to grades, was used by merchants and spinners. The system, however, only approximated quality measurement because many differences existed in grade perception as cotton passed through the marketing process, so classed cotton often was not uniform in grade.

Early cotton classers could not grade consistently because of many genetic differences of cotton fibers. Even for a given cotton type, quality varies with climate and cultural practices, such as chemical treatments, irrigation, degree of defoliation, and exposure to the elements. At harvest, cottonpickers and strippers can damage and contaminate fibers. Cleaning and drying equipment at the gin, transportation and handling on the way to the mill, and cleaning equipment at the mill all can cause quality variability and deterioration.

The growth in more stringent standards for end-product quality, as dictated by consumers, has been an important element in establishing the relationships among classes of cotton, spinning performance, and product quality. Technological advances in textile production have sharpened the importance of the relationships between processing costs and fiber quality. Poor quality fiber results in higher waste levels, increased ends down (interruptions in the yarn formation process), and more seconds in finishing operations. Manufacturers must have detailed fiber quality information to keep pace with ever-increasing processing speeds and to assess elimination of some intermediate processing steps.

Technological gains in textile production have been significant. For example, in ring spinning, spindle speeds for manufacturing a typical yarn have grown from fewer than 4,000 revolutions per minute in 1940 to more than 12,000. Weaving gains have been just as dramatic. Loom speeds have surged fromfewer than 100 pics per minute (ppm) 20 years ago to 125 to 200 on the current shuttle looms. Speeds are near 300 ppm on rapier looms. Although they do not use cotton, the new water jet looms indicate future technological developments of speeds of 700 to 1,000 ppm. Ends down and the product seconds that result from fiber quality considerations have become more critical under such technological advances.

Different end-use requirements, such as yarn strength and yarn and fabric appearance, require different fiber qualities. The ability of a fabric to hold dyes, as well as recently developed finishes such as shrink resistance, flame retardance, and durable press, depend on fiber qualities. For given product requirements or spinning characteristics, a textile producer may not be able to obtain all the raw fiber qualities needed when buying a particular genetic cotton type from a given location. Quality of a cotton variety can vary from farmer to farmer and vary tremendously from year to year. In such instances, quality measures become the basis for a recipe of sorts--the textile producer blends, or lays down, mixes of various types of cotton to obtain a specific quantity of cotton with the requisite quality measures.

Textile producers have not been alone in their interest in cotton quality measurement. Cotton shippers and merchants also use quality measures to fill textile mill orders with even-running bales, or bales of the same grade and staple. Farmers and ginners demand more and better-quality measurement, using such information to improve cotton quality with better growing, harvesting, and ginning methods. Quality measures have also become a marketing tool for the farmer, enabling farm prices to better reflect fiber quantity characteristics and product value.

Quality testing has also been important to researchers. For example, geneticists use quality measures as guidelines for developing improved cotton varieties. USDA and industry researchers employ existing quality measures to develop new measures and tests to establish relationships between fiber and end-product qualities.

USDA and Cotton Industry Testing Efforts

Grades for upland cotton were first established in 1909 with the preparation of quality standards for nine white grades (U). Efforts However, these grades were never widely used and were replaced in 1914 by the U.S. Cotton Futures Act's Official Cotton Standards. These standards were revised and became binding with the U.S. Cotton Standards Act in 1923. Standards for staple length and grade standards for American pima cotton were first established in 1918 under authority of the Futures Act. The 1923 Standards Act made the use of the official standards mandatory in interstate and foreign commerce unless the cotton was sold from actual samples or private types (purchasers buy directly from farmers and conduct their own testing). The standards were soon accepted by foreign countries and the name, universal standards, was approved. Since the early twenties, revisions of the standards have continued, with the last major revision coming in 1962. The goal of the revisions was to develop standards that are useful from a product perspective, can be uniformly applied, and are related to stable and measurable quality factors.

Quality testing traditionally has been based on human inspection. With the introduction of the official standards, visual quality determination was aided by the development of practical forms. For grade determination, a practical form is a number of boxes, each containing samples of the same grade. A classer then grades by comparing cotton to be classed to the practical forms. For staple length determination, a practical form is 1 pound of cotton of a given staple length. A classer may then compare cotton to be classed with some pulled from the comparable staple length form, using both sight and touch. The 1937 Smith-Doxey Amendment to the Cotton Statistics and Estimates Act helped make USDA classing the most pervasive quality testing procedure in the cotton industry. With passage of this amendment, USDA began providing free classing services to cotton growers at their request in an effort to motivate growers to improve quality. The importance of this service is reflected in more than 97 percent of the cotton crop being USDA classed.

Research directed at refining standards, reducing human classing errors, identifying exactly what factors describe a particular cotton, and explaining why that cotton performs the way it does has resulted in refinement of existing standards, creation of new standards, and the invention of instruments that help determine grade, staple, and character of cotton (6). One of the earliest instrument inventions, the Suter-Webb Sorter, measured the relative quantities of different fiber lengths and length uniformity contained in a sample of a particular cotton. Growth in instrument invention and refinement has surged since the twenties. Early Government and private research indicated that fiber fineness and maturity were closely related to product quality. This was reflected by increased demand from mills for cotton having these properties within a specified range. Fineness and maturity of individual fibers are indicated by micronaire readings taken from airflow instruments. The importance of the micronaire measure and the confidence in instruments to perform accurately was indicated by addition of this fiber property measure to the official USDA cotton classification system. Micronaire readings became part of the Smith-Doxey service beginning with the 1966/67 season. Instruments are the primary tool for assessing production efficiency and product quality in both USDA and private industry. USDA instruments are used to improve classer accuracy, prepare standards, and provide measures, which are not part of the official classification system, on a fee-for-service basis. For private industry, instruments have been used to grade, measure staple, ascertain character, provide a check on quality of cotton delivered, and aid product manufacturing and quality (I) Information on USDA research in the relationships between raw fiber properties and product has been published annually since 1946 in the Agricultural Marketing Service's (AMS) Summary of Cotton Fiber and Processing Test Results.

Instrument evolution has reduced the cost of using instruments. USDA and private industry have been cooperating to develop and implement a high-volume instrument (HVI) testing system. This system represents a move from primary emphasis on humans in the current USDA classification system to emphasis on instruments. Test instruments were first demonstrated by USDA in Lubbock, Tex., and Memphis, Tenn., in 1968, to evaluate their capacities to perform high volume, or production line, testing under several arrangements (7). By the seventies, the instrument test line was able to provide measures of color, fiber length, fiber fineness and maturity, length uniformity, and strength. Trash content is visually determined, and a numerical trash grade index is recorded with the other test line measures. The Secretary of Agriculture created a National Cotton Marketing Study Committee in 1974 to provide recommendations on various cotton industry issues (4). One recommendation, approved by the Secretary, called for funding of a comprehensive field evaluation of the instrument test line in a classing office environment. The test began in 1976 in Lubbock, Tex. In preparation for the test, USDA worked with the test line producer, Motion Control Inc., Dallas, Tex., to refine the line. Two test lines were installed, and almost 61,000 bales were classed during the 1976 crop year. During the 1976 to 1979 crop years, 50,000 to 70,000 bales were classed on the HVI system each year in the Lubbock laboratory. The instrument test line was accepted by USDA with the establishment of an ANS office in Lamesa, Tex., in 1980. This office classed about 300,000 samples of 1980-crop cotton.

Manufacturing interest in test lines increased when the instrument test line moved out of the laboratory and into the classing offices and textile mills. The move toward automated instrument test lines reflects, in large part, increased economies of scale. For example, using the Pressley strength tester, one operator can test 100 samples in a workday employing two specimens per sample. The three operators running an instrument test line can perform tests of strength and other factors on 600 to 800 samples. Most measures are now an average of the reading results on four specimens per sample. Economics is only a partial motivation for instrument use. Providing additional quality measures such as strength and length uniformity for the farmer, merchant, and mill buyer should assist their marketing decisions. For the cotton industry, continued improvement in, and application of, instruments will help in the search for uniform standards, accurate and repeatable tests, and constant and measurable factors on which to base quality standards. Reliance on instruments, whether brought together in the form of a test line or used independently for specific tests, is becoming common in cotton classing.

Quality Measures and Cotton Marketing

The typical marketing sequence for cotton begins with and Cotton transportation of harvested cotton to a local gin (2,9). At the Marketing gin, the cotton is dried and cleaned, the seed is removed, and the lint is packed into a 480-pound net weight bale. The cotton usually goes from the gin to a local warehouse for storage, compression, consolidation into even-running lots, and eventual disposition to domestic and foreign outlets. Although farmers sell some cotton to the gin, it is usually sold to merchants at the gin or after entering the warehouse. Most samples for quality are taken at the warehouse, the first point for sampling. Some gins, mostly in California and Texas, have mechanical samplers which collect samples during the ginning process, but such samples constitute only a small portion of samples classed. At the gin or warehouse, the bale is tagged with identification and is cut on both sides (mechanically or by hand). The two cuttings are combined to form a minimum-6-ounce sample which is identified, packaged, and sent to the bale owner or a designated place for classification. The usual destination is one of 27 USDA marketing services offices.

The marketing services office places the values for grade, staple, and micronaire on the sample's classification or green card. The green card is returned to the gin, the farmer, or designated person and is the basis for the first sale of practically all cotton. The farmer uses green card values as a check on production and harvesting methods. The values also help determine relative quality so the farmer may expect premiums or discounts, if applicable, for the marketed quality. For the ginner, the green card measures may be useful as a check on ginning methods. Green card and other quality measures permit the merchant to assemble bales into even-running lots and satisfy mill specifications.

Quality measures are used in forward contracts and on organized exchanges, in addition to uses in the usual farmer-to-merchant-to-mill marketing chain, and in direct farmer-to-mill sales. Forward contracts, which are signed prior to harvest, call for the farmer to place a quantity of cotton or production from certain acreage under contract. A single price may be set for all cotton meeting some minimum quality, a hog round contract, or the price may depend on quality deviations from a base quality, a grade and staple contract. Futures contracts, such as those on the New York Cotton Exchange, specify within narrow limits the quality acceptable for delivery. TELCOT, an electronic spot market organized in Lubbock, Tex., solicits bids by flashing quantity, quality, and asking price across a computer network. Information on quality, despite its addition to marketing cost, is essential for efficient operation of all of these alternative marketing arrangements.

2.2 Digital Image Processing Technology

Digital image processing, also known as computer image processing, refers to the process of converting an image signal into a digital signal and processing it with a computer. This process includes image enhancement, noise reduction, segmentation, restoration, encoding, compression, and extraction of features. The process of digital image processing is shown in figure 1. Image processing technology cannot be developed without the development of computers, the development of mathematics, and the growth of application requirements in various industries. In the 1960s, the image processing technology began to be applied more scientifically, and people used this technology to perform idealized processing of output images. After years of development, the current electronic image processing technology has the following characteristics: better reproducibility: Compared with traditional analog image processing and digital image processing will not be due to storage, copying, or transmission in image processing. Causes the change of image quality; The occupied frequency band is wider: this is relative to the language information, the image information is several orders of magnitude larger than the frequency band of the language information, so the image information is more difficult in the process of operation; Applicable width: data sources can be obtained from various sources.

Digital images can be processed from microscopes to astronomical telescopes. High flexibility: Electronic images can be used almost as long as they can be expressed using mathematical formulas and mathematical logic.

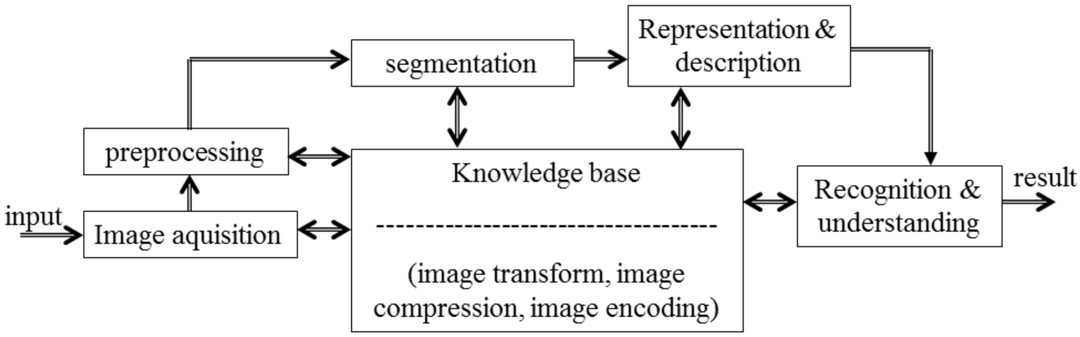


Figure 1. A schematic diagram of the process of digital image processing

Features of Digital Image Processing

Reproducibility is good: Digital image processing technology records and saves image information in binary format. As long as the original information is accurate, the processing of copying the image will not have any influence on the original image, and thus it can guarantee the real information.

High processing resolution: Digital image processing technology differs from analog technology in that it records information in the form of pixel lattices. Therefore, the storage accuracy of an image largely depends on the number of quantization bits used in the conversion and the current digital image. It can have 8, 12, 16, or higher.

Wide range of applications: Given the basic principles of digital image processing technology, it can be derived from a variety of sources, from microbes to space images, from human skeletons to lakes and mountains. Without being limited to the target's environment, they can accurately reflect their objective appearance and size. These images can all be processed by the same processing method.

Flexible processing: Traditional analog images are limited by the optical principles they generate, and thus cannot be processed in accordance with people's wishes, and can only be processed linearly; while digital images are different, it can be used for any operation including linearity. Operations and non-linear operations greatly increase the flexibility of processing and make processing easy.

Large compression space: Since digital images record and preserve information in the form of pixels, the pixel points of the brother-in-law image are not encouraged by each other, but there is some kind of connection. As long as this link is identified, a certain means of recording can be used, without having to record pixel by pixel, thereby compressing the storage space. Especially for image images, the contents of the two frames before and after are often not very different, with more than 90% of the data being the same, and the compression ratio can be very large.

The Content of Digital Image Processing Technology

Acquisition of Images. First of all, from the image acquisition, that is, the imaging point of view: to image processing, we must first obtain the image. From the perspective of the imaging sensor, there is a general TV camera that can obtain general visible light image signals; there is an infrared camera that captures infrared specifically The image has a high practical value in the military; there are acoustic wave imaging, the use of material acoustic parameters on the impact of acoustic wave propagation, can obtain information and images of the internal structure of the opaque object; with x-ray imaging, the use of objects to the penetration of x-rays Different sex, obtain information on the internal shape of the object; have γ-ray imaging, use the imaging of γ-particles in the isotope to obtain information on the function of human organs, detect normal or abnormal function of human Advances in Intelligent Systems Research, volume 163 588 organs, and use nuclear magnetic resonance imaging to take advantage of the curve changes of different substances NMR , Get information on changes in human organs and more. These imaging techniques are very easy to use 2D imaging information, using tomography and other technologies, into 2D and 3D images. The development of these technologies has an extremely important role in the medical, military, and industrial development.

Image Enhancement and Recovery. The acquired images often have various distortions and disturbances. For example, there are defects in the imaging device. For example, if the bandwidth limitation causes image blur, and the inevitable thermal noise in the imaging process and various interference noises from other interference sources, etc., in order to obtain good quality images required for people's observation processing, it is necessary to introduce image processing. This includes image enhancement and image restoration. The enhancement of the image is the use of enhanced contour edges for grayscale and color transformations, making the image more suitable for people's needs of observation and processing. The complex principle of the image is to eliminate or reduce the damage and degradation of the image caused during image acquisition and transmission. This includes image blur, image interference, and noise, and the original image is obtained as much as possible. Image restoration is often a difficult and complex inverse filtering process. Especially when the process of causing image degradation is more complicated and difficult to predict, image restoration is more difficult to perfect. Regardless of whether the image is enhanced or restored, all the pixels of the entire image must be calculated. The computational complexity of the image pixel is also enormous.

Image Compression. Another crucial issue in image processing is the compression of image data. Especially after acquiring a large number of static and dynamic images, the greatest difficulty encountered when transferring them to the user terminal or storing the images for future use is the huge amount of data of the images. For example, a frame of color image has a data amount of approximately 768 KB. If no image compression processing is performed, it is difficult to store a large amount of image data. At the same time, this problem also exists in the image transmission process, a large number of image data is difficult to quickly transfer, or the transmission of image quality requirements are very high (such as digital TV transmission rate to 100Mb / s), these are difficult transmission systems suffered. The compression of image information is a crucial issue in the storage and delivery of images, and even in the multimedia technologies mentioned later. Research on image compression coding has a long history. Up to now, new technologies and methods are still being explored. The image compression coding method mainly eliminates a large amount of data redundancy generated in the image storage process. For better results, high-definition image compression coding methods such as predictive coding, transform coding, and entropy coding can be used.

Development of Digital Image Processing Technology Since the United States began to obtain a large number of moon pictures via satellite and processed it using digital technology since 1964, more and more corresponding technologies have begun to be applied to image processing. Digital image processing also occupies an independent position as a science. The status of disciplines has begun to be used in scientific research in various fields. Another leap-forward development of image technology appeared in 1972. The sign was the birth of CT medical technology. Under the guidance of this technology, an X-ray computed tomography device was used. According to the projection of the human head, the computer processed the data. Reconstructing cross-sectional images, this image reconstruction technique was later extended to a whole-body CT device and made contributions to human development across the times. Subsequently, digital image processing technology was used in more fields and developed into a new discipline of unlimited prospects. Ten years later, digital image processing technology also developed in the deeper direction. People began to build digital human vision systems through computers. This technology is called image understanding or computer vision. Many countries have invested a lot of research energy in this area and have made profound research results. Among them, the visual computing theory proposed at the end of the 1970s provided the guiding ideology for the Advances in Intelligent Systems Research, volume 163 589 later theoretical development of computer digital image technology, but theoretically As such, there are still many difficulties in practical operation.

China began research on computer technology since the founding of the People's Republic of China. Since the reform and opening up, China's development in computer digital image processing technology has been very large. Even in some theoretical studies, it has caught up with the world's advanced level. With respect to the ability to collect imaging data, China successfully obtained a series of sensors and launches of Earth observation satellites to obtain timely and effective data on wind, sea, resources, and environmental disaster reduction, and achieved effective data. In addition, representatives of digital image processing technology in a wider range of fields are construction, traffic engineering and biomedical engineering. The application of digital image processing technology in these aspects can best reflect the current development of the technology. In the construction industry, digital image processing technology can convert the height, density, and other information that may affect building quality and the built environment into the image of the building or group of buildings to be constructed, so as to enable designers to plan more rationally; In the field of engineering, digital image technology and voice, text and other factors constitute the basic content of modern multimedia. In the process of transferring images, encoding technology is used to compress the bit amount of information. The current development content of this technology includes transform coding, etc. What may also play a role is wavelet transform image compression coding, branch coding and so on. In biomedical engineering, book image technology can objectively present the mechanism of human activities to researchers in the form of images, which has an irreplaceable role in the future development of medicine.

Application of Digital Image Processing Technology

Digital image processing technology has made great progress in all walks of life. The application fields of digital image processing are shown in table 1. In remote sensing and aerospace, many countries have dispatched reconnaissance aircraft to take aerial photographs of target areas, and then used image processing techniques to analyze photographs. This saved manpower and physics, and could also obtain other useful information from pictures. Since the 1960s, the United States and other countries have launched resource remote sensing satellites. Due to the very poor imaging conditions, the quality of the image itself is not high, and digital image processing technology is required, such as scanning with a multi-band scanner. Imaging, image resolution is 30m and these images are converted to digital signals and processed. Digital image processing technology has been widely used in various countries, such as forest surveys, disaster monitoring, resource exploration, and urban planning.

The application of digital image processing technology to the aviation field can use JPL to better process the images returned by the Moon and Mars. It is used in aircraft remote sensing and satellite remote sensing technologies, mainly through reconnaissance aircraft to a certain area of the Earth. In aerial shooting, after the required photos are processed by the image, the digital code can be stored in the air, and then the satellite can pass through the processing center when the satellite passes over the area with the receiving station. The image is analyzed in real time, and judgment reading can be processed in this process using multiple digital image processing techniques.

Field	Application
Physics and Chemistry	Spectrum Analysis
Biology and Medicine	Cell analysis; CT; X-ray analysis
Environment Protection	Research of atmosphere
Agriculture	Estimation of plants
Irrigation works	Lake, river and dam
Weather	Cloud and weather report
Communication	Fax; TV; phone
Traffic	Robot; products
Economics	IC-card
Military	Missile guidance; training

Figure 2 Application analysis table of digital image processing

Digital image processing technology first came from the medical field. Therefore, in the field of biomedical engineering, digital image processing technology has also played a huge role. In addition to the above-mentioned CT, there are still some microscopic image processing technologies, mainly to identify red blood cells, white blood cells, and chromosome analysis have played an important role in medical diagnosis and treatment of X-ray image enhancement, electrocardiogram analysis, and ultrasound image processing techniques.

Digital image processing is applied to the medical field and is mainly used in image processing technologies such as medical ultrasound imaging and X-ray angiography. Digital image processing technology plays a very important role in the further diagnosis of diseases. The digital image processing technology is applied to the actual medical field. The process is to use the image overlay technology to carry out the non-destructive test; the use of image processing technology to analyze the intelligent material has played a positive role in human exploration of the microscopic properties of the material.

In communication engineering, the main development trend of current communications is integrated multimedia communications. That is, televisions, computers, and telephones are combined and transmitted on digital communications networks. The most complex and difficult areas in the transmission process focus on images. In processing, for example, if the color television signal rate is more than 100 Mbit/s, the number of bits needed to compress the information needs to be transmitted. Therefore, the key to the success of the technology is code compression. At present, new coding methods that the country is vigorously developing, such as wavelet transform image compression coding and adaptive image network coding, etc.

In addition, digital image processing technology is often applied in communications engineering. The application of communication mainly focuses on the design of sound words and the analysis of image data. It is an organic combination of television, telephone and computer. Digital image technology is particularly important in this process. It is code compression. The current coding techniques include transform coding, adaptive network coding, and wavelet transform image compression coding.

In industrial and engineering, the main applications are focused on the quality of parts in automatic equipment wiring, stress analysis of elastic-mechanical photographs, and automatic sorting of postal letters, etc., as well as applications in intelligent robots. In military and public security, the application of digital image processing technology mainly focuses on precision guidance of missiles, investigation photographs, and transmission and display of images. In the area of public security, it is mainly used in the identification of human faces, fingerprint identification, and picture restoration. In addition to the application areas described above, the digital image processing technology has also been widely used in television image editing, costume design, hairstyle design, and restoration of cultural materials.

Digital image processing technology can also be applied to the military and public security fields, and has played an active role in these two aspects. The application in military affairs is mainly applied to the transmission of images, the storage and display of images, etc., and is most commonly used in the application of automated command systems. The application in the public security field is applied to the public security personnel to analyze and interpret the pictures sent back, and has played a good effect. The most important in the public security system is the recognition of faces and the repair of incomplete images.

The biological field is also using digital image processing technology. The biological treatment Advances in Intelligent Systems Research, volume technology in agricultural production can be applied to this technology. During the process of sowing and harvesting of crops, it is bound to produce some pests and diseases, which will directly affect the farmers' harvest and economic income. The use of digital processing technology to identify and analyze pests and diseases, and extract their characteristics, to achieve the effect of intelligent identification, so as to find the common deadly substances, to reduce pests and diseases so that agriculture can be better developed.

2.3 Summary

To sum up, the research status and major application fields of digital image processing technology, and then studies the development trend of digital image technology. At present, digital image processing technology has been widely used in life. For example, applications in networks, mobile phones, etc., the development of digital image processing technology is closely related to people's lives. With the continuous development of technology, digital image processing technology will continue to be obtained. Progress, these also need more people to study.

CHAPTER 3
SYSTEM ANALYSIS

3.1 Application Domain Analysis:

3.1.1 Cotton Fiber Properties

In most cotton, fibers range from less than 1/16 inch to more than 1-3/4 inches. Staple refers to an average of the lengths of the individual fibers, and value depends on the proportions of the different lengths represented in the cotton sample. Staple is critically important in determining product use. Thirty-one official standards exist for U.S. cotton staple. The standard intervals range from less than 13/16 inch to 1-3/4 inches, and are expressed in 1/32 inch. Staple usually refers to the length determination of the classer, and length indicates an instrument measure. The former is expressed in 1/32 inch and the latter is measured in 1/100 inch.

Character

The character of cotton is determined by identifying and measuring a number of important fiber properties.

Strength

Fiber strength contributes to the yarn and fabric strength, and is a measure of the force required to break a sample of fibers. The measures are reported in 1,000 lbs. of pull per square inch or in grams per tex. Increased speeds in modern textile spinning and weaving machinery are placing increased importance on fiber strength as a measure of cotton quality.

Length uniformity

Although staple gives an indication of average fiber length, it does not provide information on the proportions of various fiber lengths constituting the cotton sample. Measures of length uniformity describe the distribution of the fiber lengths in the sample.

Elongation

Elongation is the extent to which a fiber may be stretched, and is usually tested as part of a strength test expressed in percentage terms. Fiber elongation is related to yarn elongation which helps to withstand the stresses of the weaving process without breakage.

Stickiness

Manufacturing problems may occur if cotton fibers stick to equipment because of farm chemical sprays, oils, plant and insect sugar (secretions from insects), or fiber immaturity. One test used to indicate potential stickiness is a measurement of the sugar content of the cotton sample. Processing problems usually occur when the sugar content exceeds 0.3 percent.

Moisture content

Moisture levels are frequently determined by weighing the fiber before and after drying. Moisture is reported as a percentage of the weight of the predried specimen. Some instruments use a current flow method to determine moisture content. Controlling moisture is also important for accurately measuring other fiber properties.

3.1.2 Processing Performance

Some tests measure different facets of the same quality factors of grade, staple, and character. Many fiber properties have readily identifiable effects on textile processing and the quality of the yarn and fabric that is produced:

Grade

Grade, the earliest quality factor measured, is part of official USDA classification, and is determined on the basis of color, trash content, and preparation. There are 37 upland cotton grades. A physical standard (practical form) composed of 12 samples is available for each of 14 grades for visual grade evaluation. Descriptive standards that refer to the physical standards are used for the remaining 23 grades. Color, leaf content, and the ginning process for pima cotton require different grade standards.

5.1.1.1 Color

Cotton is normally white, but it can become spotted or assume various shades of yellow and gray, deepening in color with age and exposure to weather. Deviation from the normal white color is considered grade deterioration. Color tests evaluate brilliance, or reflectance and hue, with some chroma differences being permitted within a grade.

Trash

Grade depends on trash, the quantity and appearance of foreign matter remaining in cotton lint after ginning. Foreign matter includes seed, stem, leaf, bract, dirt, grass, bark, and particles introduced by harvesting equipment (oil, rubber) and handling (bagging, rope). Differences in trash content can determine color differences within a given grade.

Preparation

This is the effect ginning has on smoothness of the cotton lint. Machine harvesting, excessive gin drying and cleaning, and high gin production rates can lead to rougher lint. Naps and neps contribute to roughness. Naps are large, tangled masses of fibers that often result from ginning wet cotton. Neps are smaller snarled clusters of fibers that look like dots in the lint and are more difficult to remove.

3.2 Requirement Analysis

Requirements

- Desktop /Laptop
- Android Studio 3.2 (installed on a Linux, Mac or Windows machine)
- Android device in developer mode with USB debugging enabled.
- USB cable (to connect Android device to your computer).

Number of Columns and Rows in dataset

Total dataset containing the 5 classes

Each class including the 1000+ images different samples

Sample image captured by the 108p resolution and traing by teachable machine as given below

3.3 Technologies Involved

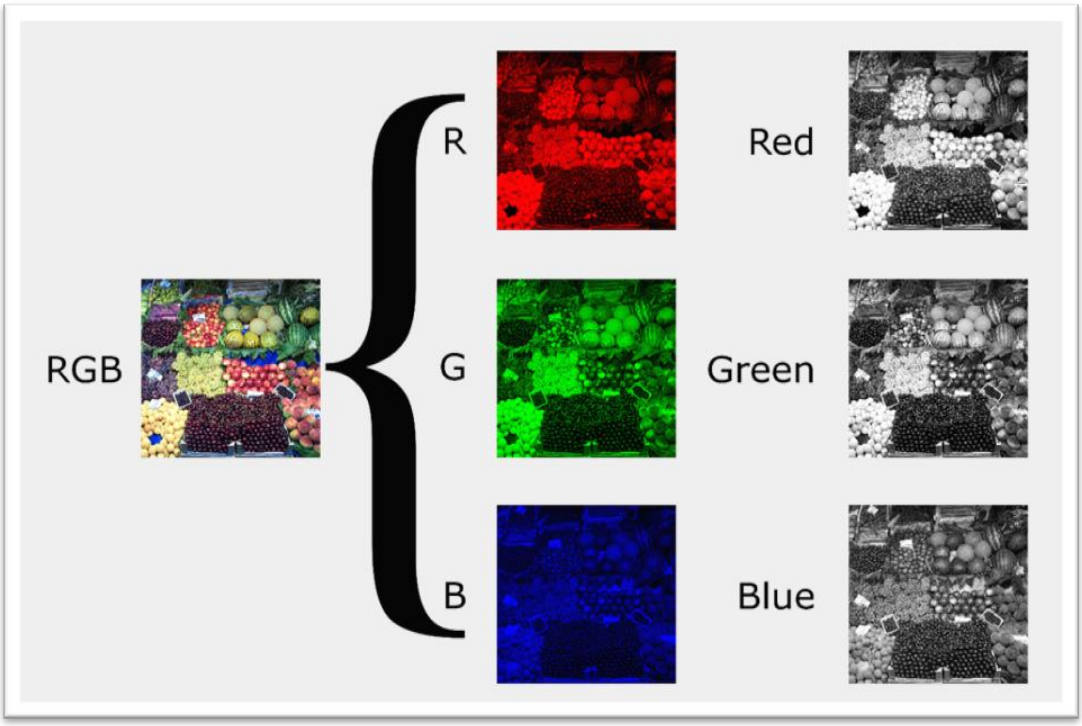


Figure 3 Grayscale Image Representation

Grayscale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelengths. Intermediate shades of gray are represented by equal brightness levels of the three primary colors (red, green and blue) for transmitted light, or equal amounts of the three primary pigments (cyan, magenta and yellow) for reflected light.

In the case of transmitted light (for example, the image on a computer display), the brightness levels of the red (R), green (G) and blue (B) components are each represented as a number from decimal 0 to 255, or binary 00000000 to 11111111. For every in a red-green-blue grayscale image, R = G = B. The lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. Black is represented by R = G = B = 0 or R = G = B = 00000000, and white is represented by R = G = B = 255 or R = G = B = 11111111. Because there are 8 s in the representation of the gray level, this imaging method is called 8-bit grayscale.

In the case of reflected light (for example, in a printed image), the levels of cyan (C), magenta (M), and yellow (Y) for each pixel are represented as from 0 to 100. For each pixel in a cyan-magenta-yellow (CMY) grayscale image, all three primary pigments are present in equal amounts. That is, C = M = Y. The lightness of the gray is inversely proportional to the number representing the amounts of each pigment. White is thus represented by C = M = Y = 0, and black is represented by C = M = Y = 100.

In some systems that use the RGB color model, there are 2^{16}, or 65,636, possible levels for each primary color. When R = G = B in this system, the image is known as 16-bit grayscale because the decimal number 65,536 is equivalent to the 16-digit binary number 1111111111111111. As with 8-bit grayscale, the lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. As one might expect, a 16-bit digital grayscale image consumes far more memory or storage than the same image, with the same physical dimensions, rendered in 8-bit digital grayscale.

In analog practice, grayscale imaging is sometimes called "black and white," but technically this is a misnomer. In true black and white, also known as halftone, the only possible shades are pure black and pure white. The illusion of gray shading in a halftone image is obtained by rendering the image as a grid of black dots on a white background (or vice-versa), with the sizes of the individual dots determining the apparent lightness of the gray in their vicinity. The halftone technique is commonly used for printing photographs in newspapers.

In some cases, rather than using the RGB or CMY color models to define grayscale, three other parameters are defined. These are . In a grayscale image, the hue (apparent color shade) and saturation (apparent color intensity) of each pixel is

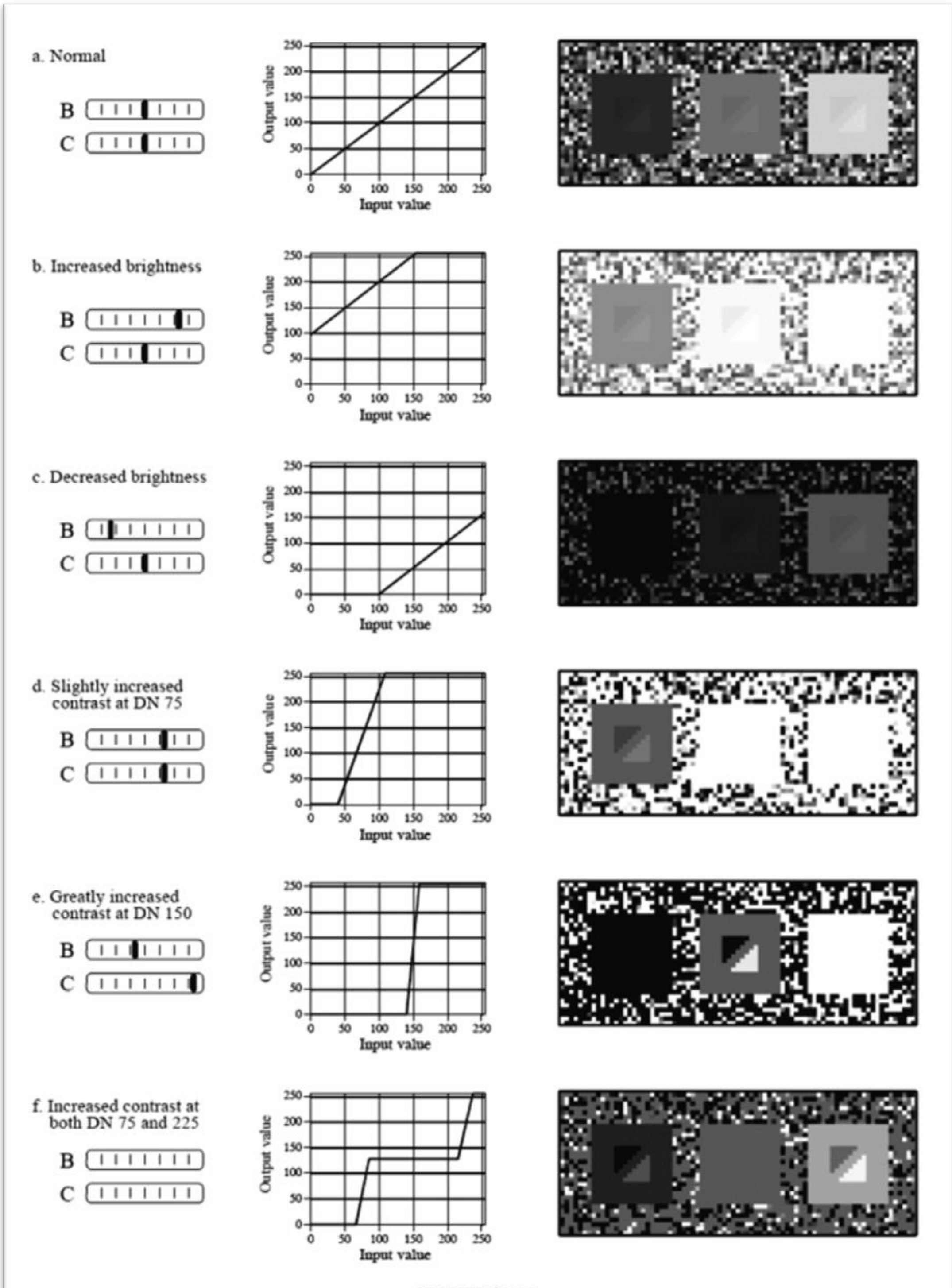


FIGURE 23-12

equal to 0. The lightness (apparent brightness) is the only parameter of a pixel that can vary. Lightness can range from a minimum of 0 (black) to 100 (white).

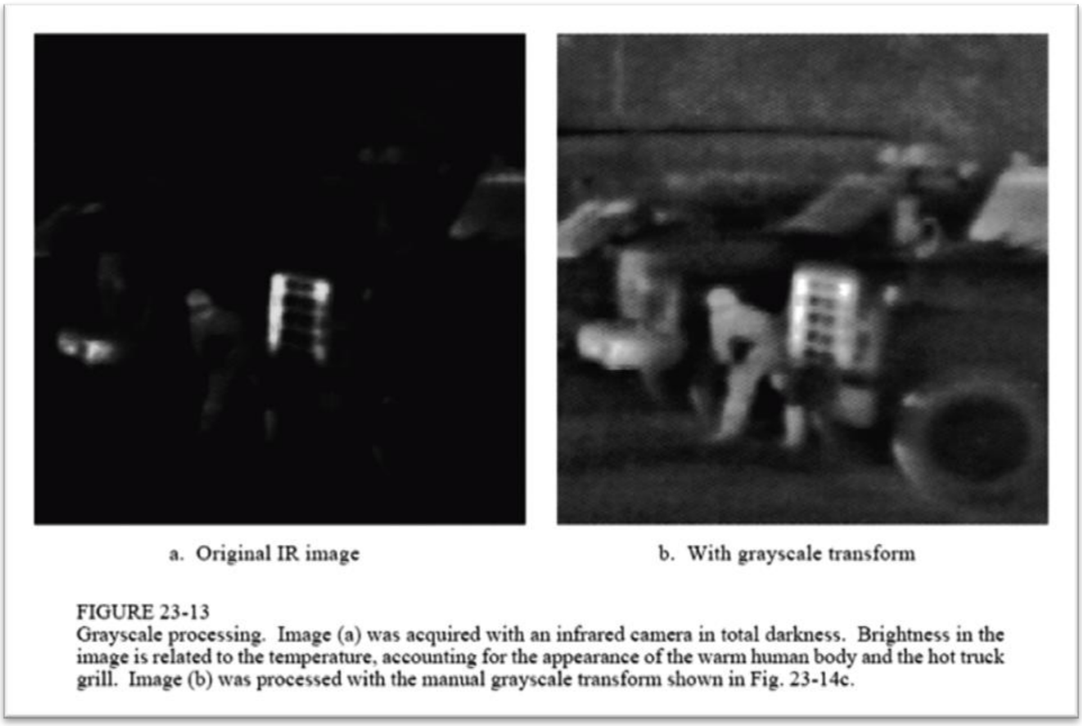


Figure 4. Grayscale Image Processing

OPENCV: -

With the current technology trends, computer vision has become an important entity in the technology field leading to limitless computer innovations. Think about computer vision from this perspective: As humans, our eyes are an important part of the body and so is embedding vision to computers/machines so as to allow them to see. So, to do that we are going to use Haar cascade method let's see first what is haar cascade Shortly Haar Cascade is a machine learning object detection algorithm used to identify objects in an image or video and based on the concept of features proposed by Paul Viola and Michael Jones in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. 16 It is a machine learning-based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. A Hear feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region, and calculates the difference between these sums. some the Hear features.

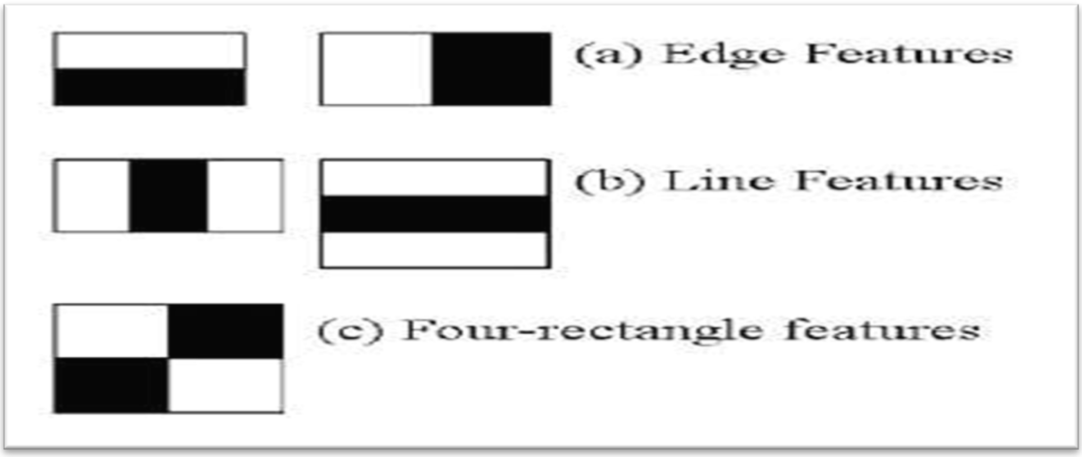
OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 18 million. The library is used extensively in companies, research groups and by governmental bodies.

Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, VideoSurf, and Zeitera, that make extensive use of OpenCV. OpenCV's deployed uses span the range from stitching streetview images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan.

It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. A full-featured CUDA and OpenCL interfaces are being actively developed right now. There are over 500 algorithms and about 10 times as many functions that compose or support those algorithms. OpenCV is written natively in C++ and has a templated interface that works seamlessly with STL containers.

OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more. It supports multiple languages including python, java C++. Although, for this article, we will be limiting to python only.

The library is equipped with hundreds of useful functions and algorithms, which are all freely available to us. Some of these functions are really common and are used in almost every computer vision task. Whereas many of the functions are still unexplored and haven't received much attention yet.



CIFAR-10 IMAGE CLASSIFICATION IN TENSORFLOW: -

The CIFAR-10 dataset consists of 60000 32×32 colour images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images. Recognizing photos from the cifar-10 collection is one of the most common problems in the today's world of machine learning. I'm going to show you – step by step – how to build multi-layer artificial neural networks that will recognize images from a cifar-10 set with an accuracy of about 80% and visualize it.

TEACHABLE MACHINE: -

Train a computer to recognize your own images, sounds, & poses.

Teachable Machine is a web-based tool that makes creating machine learning models fast, easy, and accessible to everyone. A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

You can use Teachable Machine to recognize images, sounds or poses. Upload your own image files, or capture them live with a mic or webcam. These examples stay on-device, never leaving your computer unless you choose to save your project to Google Drive. Gathering image examples.

CHAPTER 4

SYSTEM DESIGN

4.1 System Architecture:

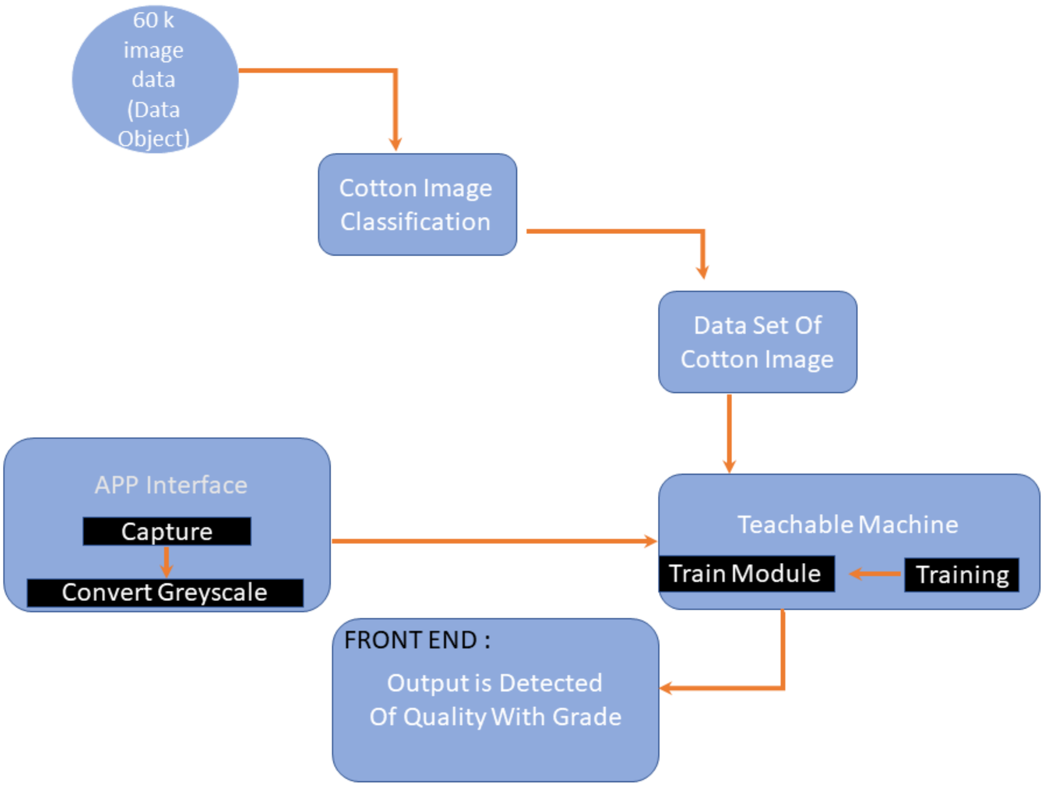


Figure 5. System Architecture

Our system will work according to the system architecture show in below figure, it will first capture the image throuth a digital camera or else it will capture through Database. Every image will be normalizied to predifined size for the further process. For Dimentianality redunction we use feature extraction methods like M-BTC (Block Transition Coding), Histogram Equlization,etc. Through a image, feature vectors are created for by extractingng the feature by using different methods like MBTC (Block Transition Coding), Histogram Equlization,etc. This processed image will be given to the NN for the classification procesinteract with use cases, but they have no say in how they're used.

There are many open-source frameworks used for implementing deep learning. The most popular framework is Tensorflow. It is a framework that is used to implement Deep Learning. Deep Learning deals with making computer recognize objects, shapes, speech on its own. It can also be thought similar to machine Learning. In traditional applications the computers are given knowledge about how to recognize the unique features of an object manually by humans, but that's not the case with Deep Learning. In deep learning we build neural networks that does the task of identifying the features of an image. The neural network has one input layer, n hidden layers and one output layer. Once you input the image, it traverses through n hidden layers, each responsible for performing specific operation, and finally produces the output at the output layer. In this way instead of manually making the system understand how to classify the images we will ask the system to learn by itself by finding various patterns within different images and assign appropriate classes. Our system also deals with creating different types of neural networks that will train itself by observing the patterns in it. Currently our system focuses on creating only 4 classes namely (indoor, outdoor, cat, dog). Our system is developed using Python and Tensorflow framework for CPU based and using CUDA library for GPU based. The performance with CPU and GPU will be measured by evaluating different parameters like execution time, accuracy of classification and so on.

4.2 Context Diagram:

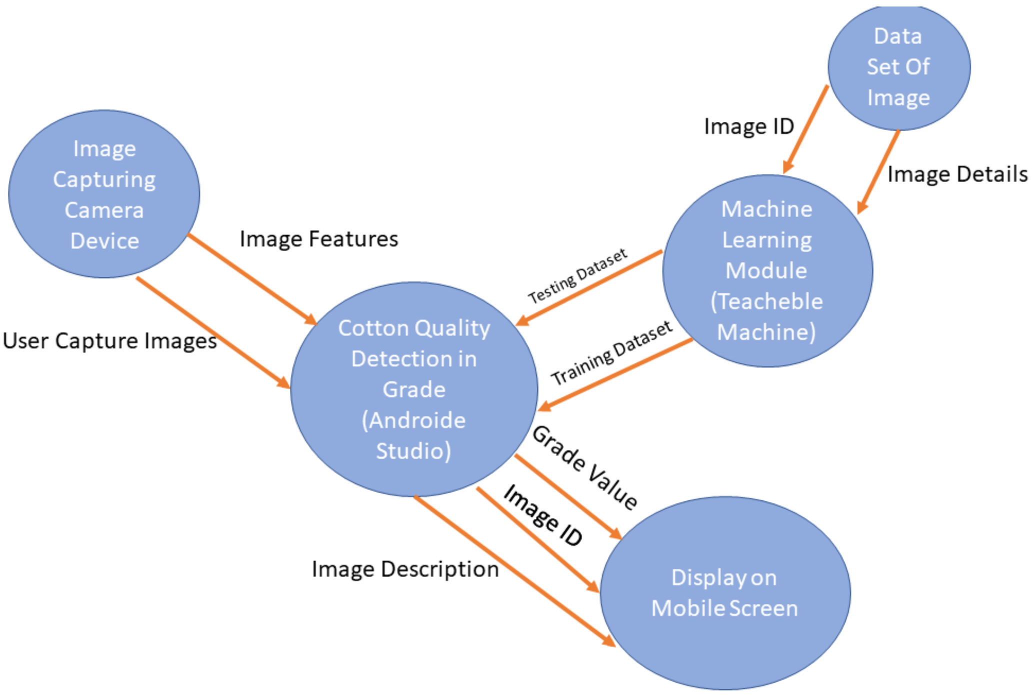


Figure 6. Context Diagram

Computers see an input image as an array of pixels, and it depends on the image resolution. Based on the image resolution, it will see height * width * dimension. E.g., An image of a 6 x 6 x 3 array of a matrix of RGB (3 refers to RGB values) and an image of a 4 x 4 x 1 array of a matrix of the grayscale image.

These features (data that's processed) are then used in the next phase: to choose and build a machine-learning algorithm to classify unknown feature vectors given an extensive database of feature vectors whose classifications are known. For this, we'll need to choose an ideal algorithm; some of the most popular ones include Bayesian Nets, Decision Trees, Genetic Algorithms, Nearest Neighbors and Neural Nets etc.

The algorithms learn from the patterns based on the training data with particular parameters. However, we can always fine-tune the trained model based on the performance metrics. Lastly, we can use the trained model to make new predictions on unseen data.

At present, there are more than 250 programming languages in existence, according to the TIOBE index. Out of these, Python is one of the most popular programming languages that's heavily used by developers/practitioners for Machine Learning. However, we can always switch to a language that suits the use case. Now, we'll look at some of the frameworks that we utilise for various applications.

Today, several machine learning image processing techniques leverage deep learning networks. These are a special kind of framework that imitates the human brain to learn from data and make models. One familiar neural network architecture that made a significant breakthrough on image data is Convolution Neural Networks, also called CNNs. Now let’s look at how CNNs are utilised on images with different image processing tasks to build state of the art models.

The convolutional neural network is built on three primary layers, which are:

(1) Convolutional Layer

(2) Pooling Layer

(3) Fully Connected Layer

4.3 Use Case Diagram

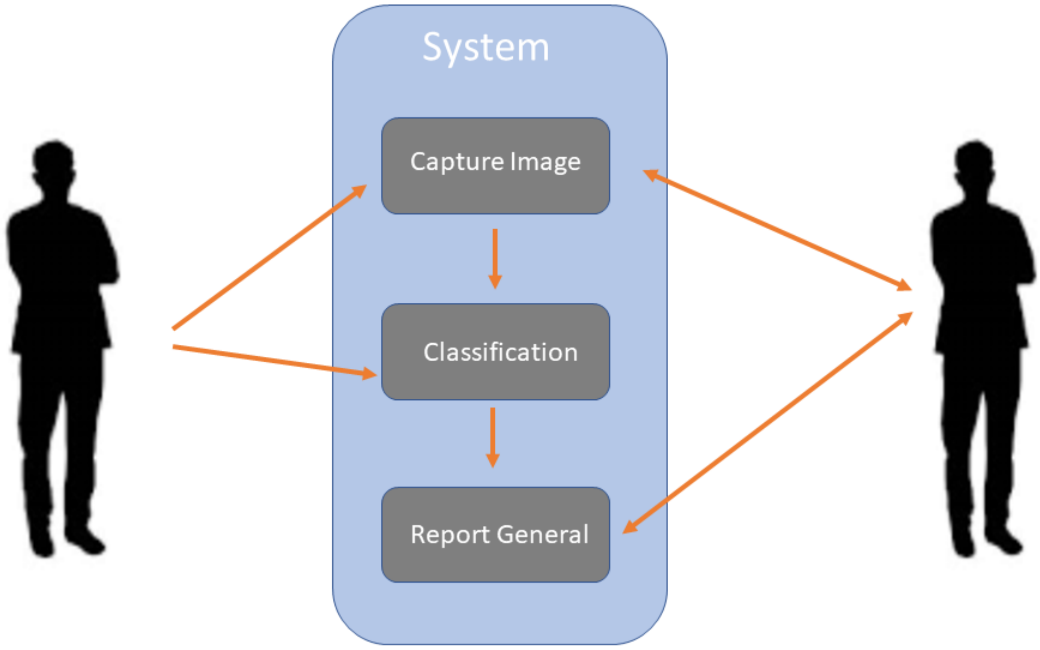


Figure 7. Use Case Diagram

In the System Design Document, you'll find information about the software's functional requirements, the operating environment, the architecture of the system and subsystems, the files and databases you'll use, input formats, output formats, human-machine interfaces, and processing logic.

Instance of Widespread Utilization Diagrams:

i. Actors' names and locations:
ii. Actor: An actor depicts the part played by the user in relation to the system.
iii. Actors interact with use cases, but they have no say in how they're used.

This use case could be described as follows for a more detailed explanation:

Actor-system interactions that result in a pattern of behavior. Actor-system interactions that result in related transactions. Usage cases are an effective way to collect data like system requirements, communicate with customers and test a product's functionality Finding use cases is as simple as examining the system's users and figuring out what they can do with it.

The following are some general use case guidelines to keep in mind:

- Describe the scenarios in which you'll be using the product.
- Using terms that the user is already familiar with, briefly describe the use cases. As a result, the description is clearer.

Use-case identification questions include the following:

- What are the roles and responsibilities of the various actors?
- The answer to this question depends on the actors involved.
- For what purposes will you store, modify, delete, or access this data?
- Is there a requirement for any actor to notify the system of unexpected external changes?
- Are certain occurrences in the system something that actors need to be informed about?
- Which use-cases will keep the system running?

CHAPTER 5

IPLEMENTATION AND RESULTS

5.1 System Modules Implementation

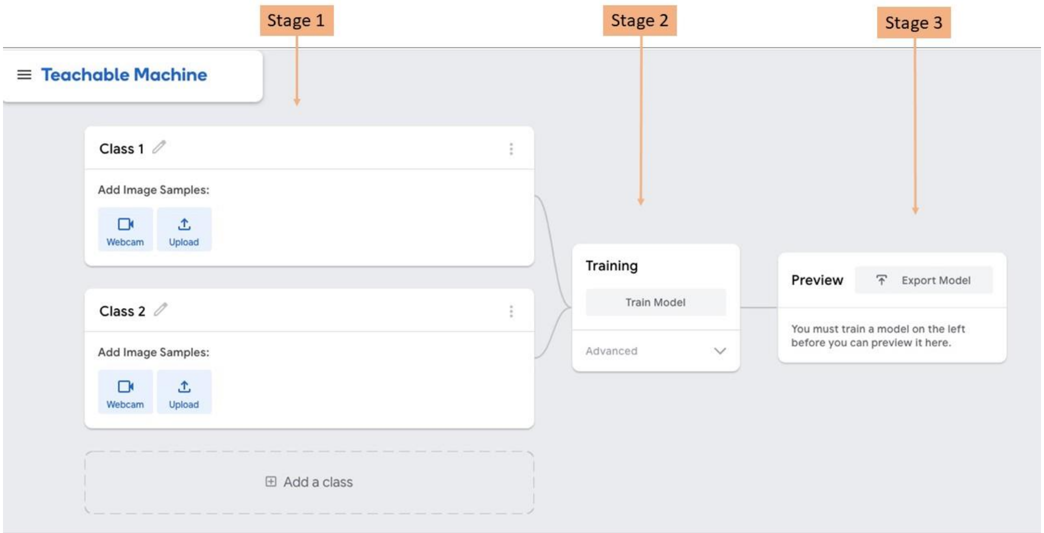
In any project involving creation and deployment of a Machine Learning model, there are certain inescapable stages which are required to be traversed. These stages can be summarized as follows: -

Stage1: Gather data samples and pre-process the data

Stage2: Create a Suitable Machine Learning Model with Convolutional and Deep Neural Networks and Train it with your data

Stage3: Deploy the model and carry out Inference and Prediction

Without a tool like Teachable Machine, one has to implement each of the above stages manually. Often, implementation of these stages require sound understanding

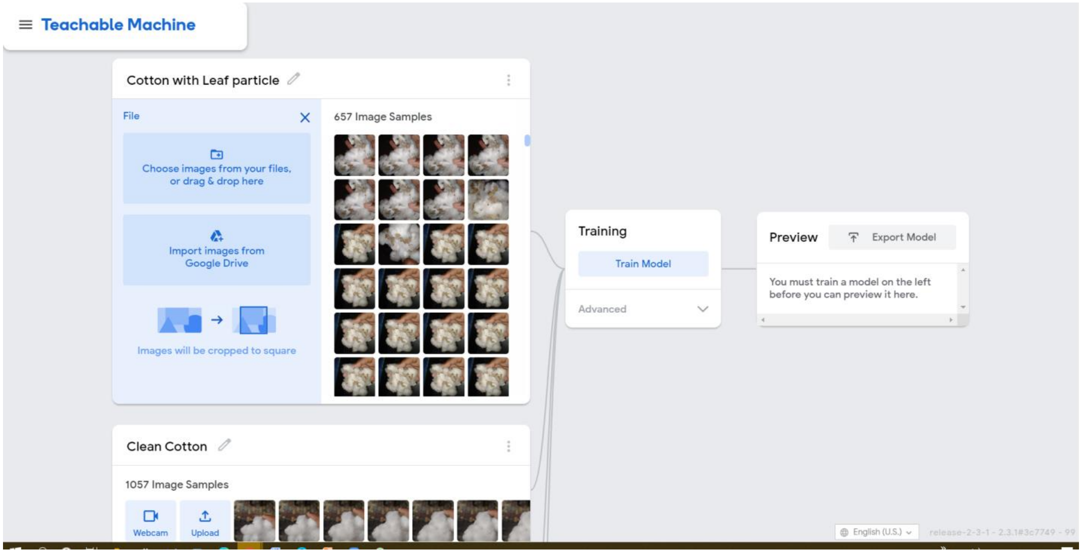


of this field with expertise in programming languages such as Python / R /java.

Teachable Machine absorbs all that complexity and provides a simple GUI (shown below) which implements all the stages mentioned above to get you started and enables you to experiment with Machine Learning models in the quickest possible way. The GUI is quite intuitive which depicts the various stages in a sequential flow as shown below.

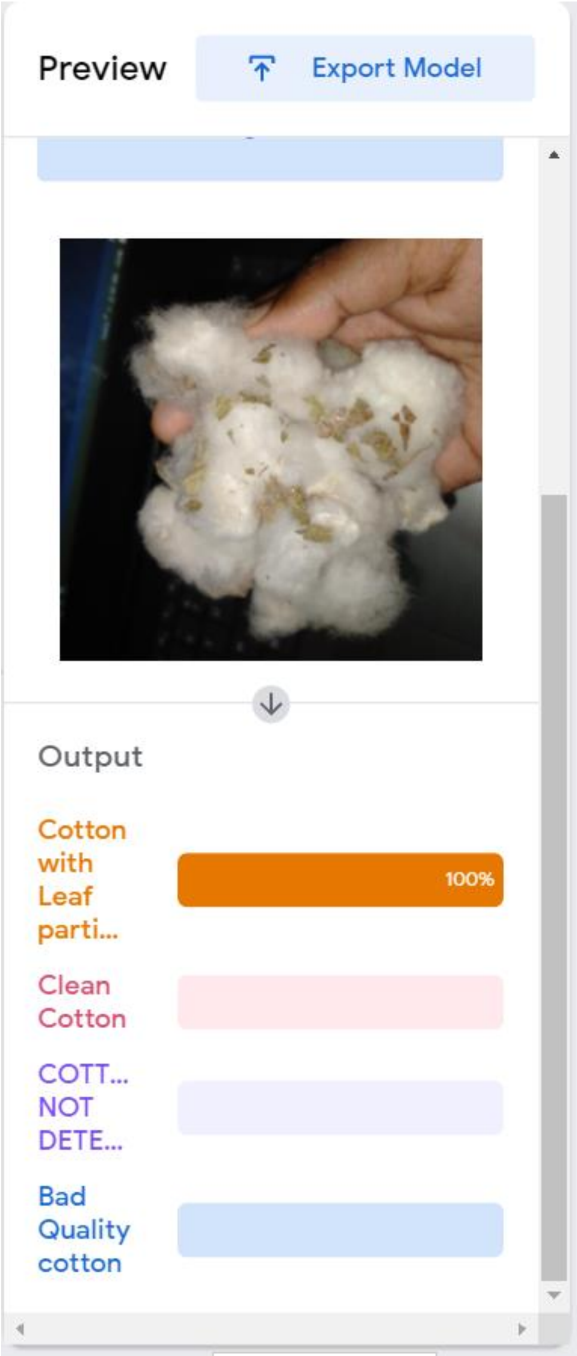
As of this writing, you can create 3 types of Machine Learning models using Teachable Machine. One, that can recognise images. Second, that can recognise sounds and third that can recognise body poses. For this project, i have used the Image Model and trained it for my use case.

The first stage is to gather the data samples. The data in this project is images. You can either upload the images or allow to tool to access the webcam of your device to capture them. Once allowed, the tool accesses the webcam of laptop and starts capturing the images as long as you hold the record button.

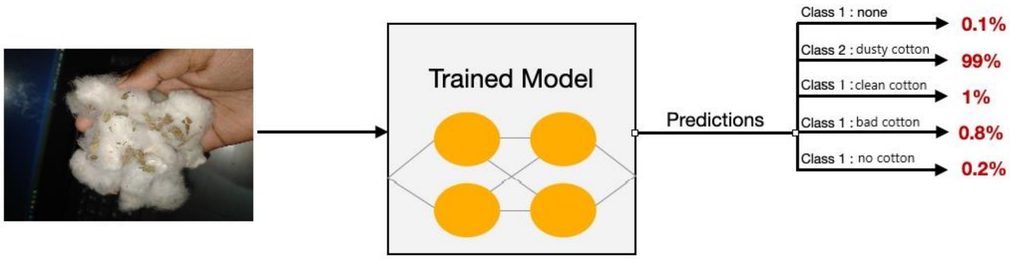


You can group different types of cotton samples in different classes and name them accordingly. In my case i have taken picture samples under 7 classes as shown below.

Under the hood, the javascript code embedded in the app page continuously captures the images through cam. For each frame, the code performs inference using the model you just trained. The model returns prediction probabilities with respect to the classes it was trained with. More the resemblance with a class, higher its prediction probability. The picture shown below tries to emphasise the fact that for every webcam frame input, the trained model returns probabilities of its match



with all the classes. Since, I have trained the model with 5classes, it returns the prediction probabilities w.r.t these 5 classes. You can define any number of classes based on your application. When the data in a frame is closer to a particular class, the prediction probability returned by the model for that particular class is higher in comparison to other classes.



In above example, the probability returned by the sample for leaf particle is 99% and for others is less than 1%. That means the model can distinctly recognise this model. These probabilities fluctuate as the subject moves in front of the cam.

This is the default deployment scenario provided by Teachable Machine, wherein, the model gets trained and deployed in the application. Now, the interesting part is that you can export this trained model and tweak the snippet provided in the export section to make it work in your application outside the Teachable Machine. Let's see how to do that.

In order to use the model in other project, you need export it using 'Export Model' button in preview section. When you press 'Export Model' button, a screen appears as shown in the pic below. The key points to remember while downloading the model are annotated on the pic below.

1. Click on TODO 1 in the TODO list or open the **MainActivity.kt** file and locate TODO 1, initialize the model by adding this line:

```
privateclassImageAnalyzer(ctx:Context,privateval listener:RecognitionListener):
    ImageAnalysis.Analyzer{

 ...
 // TODO 1: Add class variable TensorFlow Lite Model
```

```
  privatevalflowerModel=FlowerModel.newInstance(ctx)

  ...
}
```

2. Inside the analyze method for the CameraX Analyzer, we need to convert the camera input ImageProxy into a Bitmap and create a TensorImage object for the inference process.

   Note that current tooling requires image input to be in **Bitmap** format.

- This means if the input is a file rather than **ImageProxy**, you can feed it directly to the method **fromBitmap** as a **Bitmap** object.
- If you are interested in how **ImageProxy** is converted into **Bitmap**, please check out the method **toBitmap** and the **YuvToRgbConverter**. We expect the needs for these methods to be temporary as the team works towards **ImageProxy** support for **TensorImage**.

```
override fun analyze(imageProxy:ImageProxy){
  ...
  // TODO 2: Convert Image to Bitmap then to TensorImage
  valtfImage=TensorImage.fromBitmap(toBitmap(imageProxy))
  ...
}
```

3. Process the image and perform the following operations on the result:

- Descendingly sort the results by probability under the attribute score with the highest probability first.
- Take the top k results as defined by the constant MAX_RESULT_DISPLAY. You can optionally vary the value of this variable to get more or less results.

```
override fun analyze(imageProxy:ImageProxy){
  ...
  // TODO 3: Process the image using the trained model, sort and pick out the top
results
  val outputs =flowerModel.process(tfImage)
      .probabilityAsCategoryList.apply{
          sortByDescending{it.score}// Sort with highest confidence first
      }.take(MAX_RESULT_DISPLAY)// take the top results
```

```
 ...
}
```

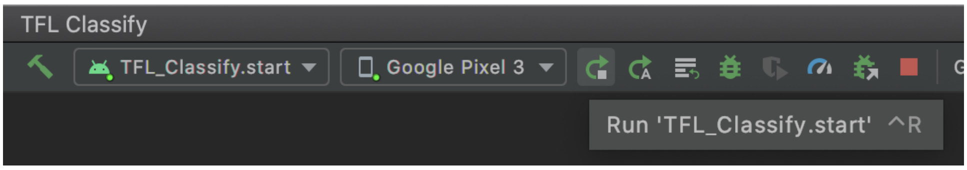
4. Convert the sorted and filtered results into data objects Recognition ready to be consumed by RecyclerView via Data Binding:

```
override fun analyze(imageProxy:ImageProxy){
 ...
 // TODO 4: Converting the top probability items into a list of recognitions
 for(output in outputs){
     items.add(Recognition(output.label,output.score))
 }
 ...
}
```

5. Comment out or delete the following lines which help generate the fake results we see before:

```
// START - Placeholder code at the start of the codelab. Comment this block of code out.
for(i in0..MAX_RESULT_DISPLAY-1){
   items.add(Recognition("Fake label $i",Random.nextFloat()))
}
// END - Placeholder code at the start of the codelab. Comment this block of code out.
```

8. Run the app on a real device by selecting TFL_Classify.start and press the run button on the toolbar:



5.2 Execution and Result Verification

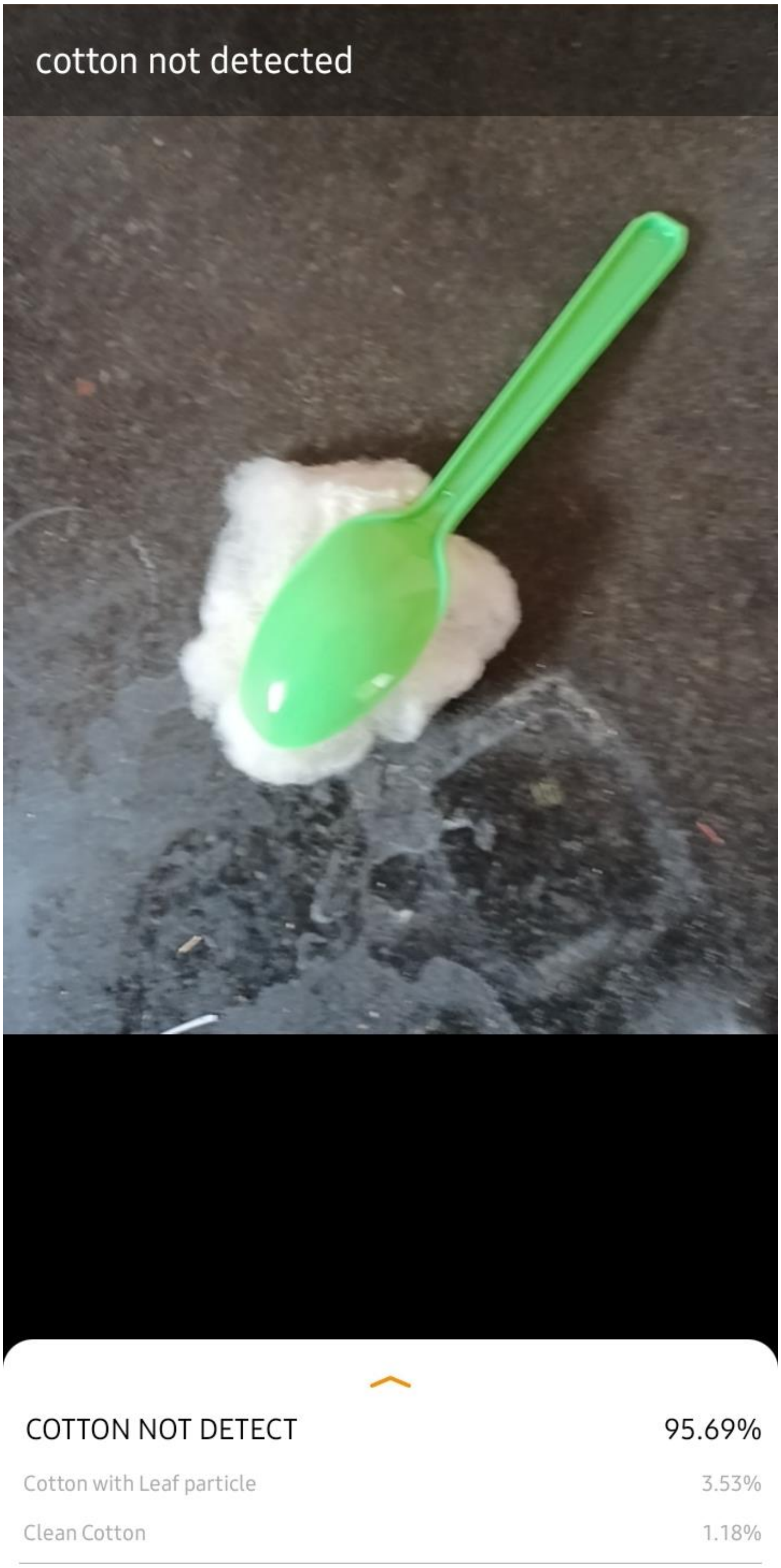
1. Application User Interface

2. Clean Cotton Detected

3. Cotton with Dusted Leaf Detected

4. Cotton affected by Pink Bollworn Detected

5. Cotton not detected due to out-range object



CHAPTER 6

CONCLUSION

6.1 CONCLUSION:

Thresholding is simpler method for cotton recognition in image but it has high noise factor and it does not perform well in image with high sunlight. Shape and fractal-based method give acceptable result but it involves complexity in algorithm. Method based on human visual system gives good result when number of sub-block images is 4x4. Otherwise, the segmentation will be failure because too many backgrounds joining in ROI. So, all above mention method can be used to recognize cotton flower but with some apply condition. One could develop algorithm which is robust in all condition whether it is noise or problem of high sunlight or occlusion of cotton with other one. Future work will be done in the same direction by considering only color components of cotton flower image by using gamma correction or gamma adjust to find white cotton object.

6.2 LIMITATIONS:

Metrics are key to assessing the performance of image analysis algorithms in an objective and meaningful manner. So far, however, relatively little attention has been given to the practical pitfalls when using specific metrics for a given image analysis task. An international survey (Maier-Hein et al., 2018), for example, revealed the choice of inappropriate metrics as one of the core problems related to performance assessment in medical image analysis. Similar problems are present in other fields of imaging research (Correia & Pereira, 2006; Honauer, Maier-Hein, & Kondermann, 2015). Under the umbrella of the Helmholtz Imaging Platform (HIP)1 , three international initiatives have now joined forces to address these issues: the Biomedical Image Analysis Challenges (BIAS) initiative2 , the Medical Image Computing and Computer Assisted Interventions (MICCAI) Society's challenge working group, as well as the benchmarking working group of the MONAI framework3 . A core mission is to provide researchers with guidelines and tools to choose the performance metrics in a problem-aware manner. This dynamically updated document aims to illustrate important pitfalls and drawbacks of metrics commonly applied in the field of image analysis. The current version is based on a

Delphi process (Brown, 1968) on metrics conducted with an international consortium of medical image analysis experts.

6.3 FUTURE WORK:

We all are in midst of revolution ignited by fast development in computer technology and imaging. Against common belief, computers are not able to match humans in calculation related to image processing and analysis. But with increasing sophistication and power of the modern computing, computation will go beyond conventional, Von Neumann sequential architecture and would contemplate the optical execution too. Parallel and distributed computing paradigms are anticipated to improve responses for the image processing results.

The future of image processing will involve scanning the heavens for other intelligent life out in space. Also new intelligent, digital species created entirely by research scientists in various nations of the world will include advances in image processing applications. Due to advances in image processing and related technologies there will be millions and millions of robots in the world in a few decades time, transforming the way the world is managed. Advances in image processing and artificial intelligence6 will involve spoken commands, anticipating the information requirements of governments, translating languages, recognizing and tracking people and things, diagnosing medical conditions, performing surgery, reprogramming defects in human DNA, and automatic driving all forms of transport. With increasing power and sophistication of modern computing, the concept of computation can go beyond the present limits and in future, image processing technology will advance and the visual system of man can be replicated.

Wide research is being done in the Image Processing technique. Some of them are mentioned below:

❖ Cancer Imaging – Different tools such as PET, MRI, and computer aided detection helps to diagnose and be aware of the tumour.

❖ Brain Imaging – Focuses on the normal and abnormal development of brain, brain ageing and common disease states.

❖ Image processing – This research incorporates structural and functional MRI in neurology, analysis of bone shape and structure, development of functional imaging tools in oncology, and PET image processing software development.

CHAPTER 7
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