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Development of Automatic Sesame Grain Classification and Grading System Using Image Processing Techniques

Hiwot Desta Alemayehu
Ethio-Telecommunication Company, Ethiopia

Sesame is one of the most important agricultural products traded internationally where its flow in the market needs to comply with the rules of quality inspection. Ethiopia is one of the largest producers and exporters of sesame in the world. The country produces three types of sesame grains: whitish Humera, whitish Wollega and reddish Wollega. To be competitive in the market, it is essential to assess the quality of sesame grains. Ethiopian Commodity Exchange (ECX) currently uses a manual grading system to assess the quality of the product. However, this technique is time consuming, expensive, in accurate and labor intensive. Accordingly, it is essential to have an automated system which rectifies these problems. Thus, in this thesis, we present an automated system for classification and grading sesame based on the criteria set by the ECX. The system takes pictures of sample sesame grains and processes the image to set the classes and grades. A segmentation technique is proposed to segment the foreground from the background, partitioning both sesame grains and foreign particles. The segmentation process also forms the ground work from which feature extractions are made. Color structure tensor is applied to come up with a better preprocessing, segmentation and feature extraction activities. Furthermore, watershed segmentation is applied to separate connected objects. The delta E standard color difference algorithm, which generates six color features, is used for classification of sesame grain samples. These six color features are used as inputs for classification and the system generates 3 outputs corresponding to classes (types) of Ethiopian sesame grains. Grading of sesame grain samples is performed using a rule based approach, where the classification output will be fed with 4 inputs and five or six outputs, corresponding to the morphological (size and shape) features and grades, respectively. On top of that, calibration is introduced to standardize the entire system. Experiments were carried out to evaluate the performance of our proposed system design. The classifier achieved an overall accuracy of 88.2%. For grading of sesame grain samples, we got an accuracy of 93.3%, far better than the manual way of grading.

Keywords: Sesame grading system, Digital image processing, Color structure tensor, Watershed segmentation, Reconstructed Image, Delta E Color Difference, Calibration Process.

Biography:

Hiwot Desta as graduated my MSc. from Addis Ababa University in the department of computer science in 2018 G.C. During Hiwot Desta studies, she have been enjoying gaining a solid background in Imaging, Image process and Signal Processing, Computer Architectures, Programming, database and networking. This is a great opportunity that gears me up to fulfil my career as a professional researcher. At present, Hiwot Desta a researcher and an employee in Ethio-Telecommunication Company.