AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

Primal to Steak

Proof-of-Concept Project for Meat Traceability

| Project Code	Prepared by	Date Submitted
2021-1268	Griffith University	20/02/2022

Project Description

A grand challenge in establishing meat traceability lies in the physical separation between meat products and their labels. This is especially the case at the downstream of the meat supply chain when products reaching end consumers. While tamper-proof packages could be used, they do not always achieve what they are designed for and require additional costs.

To address this challenge, this project validates the concept of using meat products themselves as unique 'fingerprints' to establish supply chain traceability. The concept assumes that meat images are taken at meat processing facilities and are uploaded to a server, which is controlled by meat processors or trustworthy third parties. Once products reach end consumers, they can use their mobile phones (or similar devices) to take photos of the meat products and query their authenticity by uploading the photos to the authentication server. The authentication server compares the uploaded product photos from both the meat processors and the consumers and sends back to the consumers the authentication outcomes.

Project Content

The project team applied the overall process shown below to correctly recognise whether two photos are coming from the same piece of meat. The identification framework first removes the background so that contour of the meat could be easily constructed as it is essential to have such information for meat identification. The LRsCoM method, which was designed and developed by the project team, was then applied to extract the features of the contour so that difference with other contours (measured as 'distance') could be calculated. A threshold was then applied to the distance to indicate whether two photos are from the same piece of meat or not. The project team tested 40 pieces of unpackaged beef and 11 packs of packaged beef.
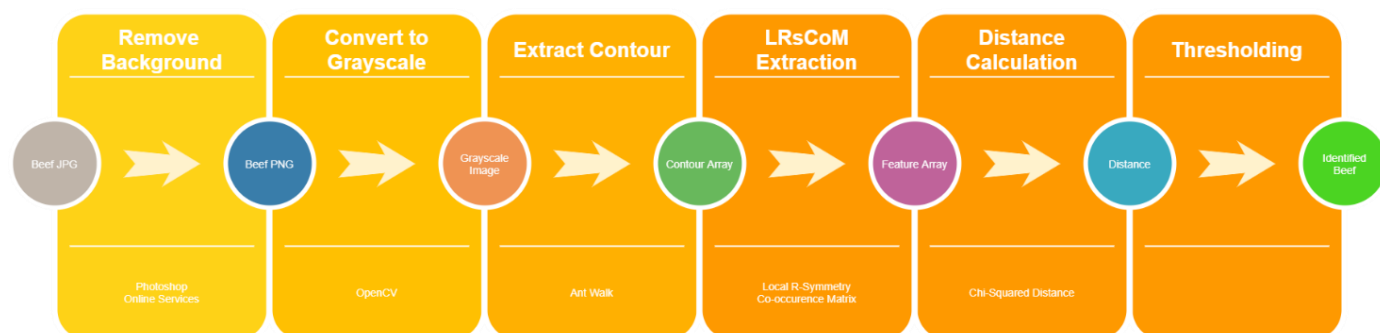
Project Outcome

The results for unpackaged beef showed an accuracy of 99.15%, 89.83% precision, and 74.65% recall, as can be observed from the comparison number table below. By checking these statistics, it is reasonable to conclude that the proposed approach works for unpackaged beef, albeit there is still room for improvement. It should be mentioned that the unpackaged beef products were tested until they went off therefore demonstrate the robustness of the approach. The figure below present two examples of photos of the same pieces of beef recognised as the same pieces of beef.

Number of Results: 5680	Predicted Positive	Predicted Negative
Actual Positive	106 True Positives (TP)	36 False Negatives (FN)
Actual Negative	12 False Positives (FP)	5526 True Negative (TN)
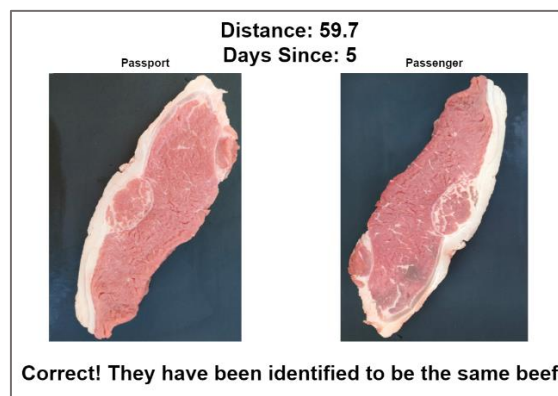
For packaged beef, the project team reached an accuracy of 92.56%, 100.0% precision, and 18.18% recall, as shown in the comparison number table below. Based on these statistics, applying the same approach to the unpackaged beef is not an accurate meat identification approach. Therefore, further research will be required.

Number of Results: 363	Predicted Positive	Predicted Negative
Actual Positive	6 True Positives (TP)	27 False Negatives (FN)
Actual Negative	0 False Positives (FP)	330 True Negative (TN)

Benefit for Industry

The results obtained in this proof-of-concept project indicate that beef without packages can be correctly identified. This means a game changing approach could be applied to meat traceability. Meat processors, for the first time, could control all the information required for meat traceability without relying on the various handling parties in the downstream of the meat supply chains.

Food provenance is becoming an increasingly important consideration for consumers, particularly within export markets where there have been cases of fraudulent products entering the retail stream. By implementing the proposed meat traceability approach, Australian meat processors can reassure consumers the products they purchase and therefore boost consumer confidence in Australian meat, which should consequently increase the sales volume.

Being able to provide meat traceability information also opens the window for product differentiation. For example, farmers and meat processors can advocate the region their meats are farmed and the natural farming approaches used.