

# Automating Durian Grading

Whitepaper



# Durian Industry in Malaysia

Durian, also crowned as the King of Fruits receives different opinions from the public. Some favour it, and some do not, but what is more important is that it is a fast-growing industry in Malaysia. It is worth noting that durian is one of Malaysia's sources of agricultural wealth.



Malaysian durian exports increased by 107 percent from **69.9 million ringgit** to **144.7 million ringgit** between 2016 and 2020.

Source: Malaysia's Deputy Minister of Agriculture and Food Industries,

Malaysia has durians in abundance, especially during the durian season, since it is one of the main exporters of durians to Hong Kong, Singapore, and Mainland China. Durian lovers are said to be willing to spend hundreds of ringgit just to have a taste of the infamous Musang King Durian, which is worth RM800 to RM900 a box. To meet such needs, it is important to keep the durian supply going.

## Challenges in Durian Industry

The durian industry suffers from setbacks just like any other industry. These are some significant challenges that the durian industry faces:

The durian industry is no escape from the COVID-19 impact. In 2020, the durian industry in Malaysia faced a sharp decline in demand and manpower shortages. This was due to the fact that strict Movement Orders prevented plantation workers from working on the farms. They were not able to travel to the farm because of the distance limit, which led to a decreasing production rate since durian trees in large areas are high maintenance that need proper care. **This leads to revenue loss due to low-quality durians that were not taken care of, insufficient stocks, and a higher price.**

Durian trees are sensitive to climate changes. A humid and wet climate will attract pests and diseases that soon result in the death of durian trees. The most common disease in durian trees is named stem canker. Without poor agricultural practices and proper treatment, the whole orchard can be infected and it will make the yield go down.

Other than that, squirrels are the main culprit when it comes to damaging the fruit. **Since durian takes a long period to reach maturity, it can be pinpointed that proper technology, along with enough skilled workforce are crucial to the industry.** On May 14 2022, Malaysia's Deputy Agriculture and Food Industry Minister, Ahmad Hamzah, stated that durian enthusiasts, particularly those who prefer premium types such as Musang King and Black Thorn, will face a price hike of up to 100% during this year's durian season. This is due to a 50 per cent drop in durian production due to weather conditions, he said.



The **Black Thorn** species is projected to cost more than RM100 per kilogramme.

And **Musang King** would cost between RM60 and RM80 per kilogramme, depending on grade.



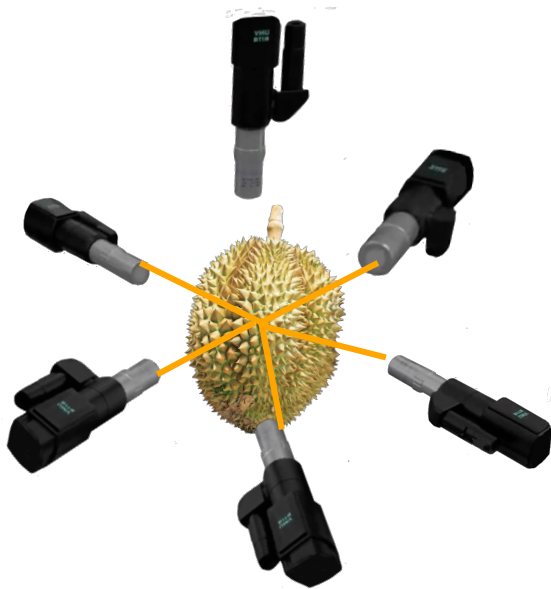
As we all are aware, there is no proper grading standard when it comes to durian. The grades are generally set depending on their sweetness, sizes, and segments. According to FAMA, closer to 4 kg and above durian is considered class A but this is not fixed. The more the segments and the rounder the shape, the better the grade. The price is set based on the types of durian such as Musang King or Black Thorn. Hence, this makes it harder to set the price in the market as it all depends on the seller's experience and skills in identifying the durian. Some snobbish sellers will take advantage of customers who lack knowledge in choosing the best durian. However, that is not all. No proper grading standard also means that the process is prone to human error. **Due to the durian's complex shape and texture, it is hard for human eyes to accurately detect the grade of durian.** Tiredness, lack of knowledge, and carelessness are the main causes of human error. A single mistake will have a domino effect, such as losing the trust of customers and eventually ruining the business' reputation.

To overcome these challenges that are putting the durian industry on pins and needles, **Tapway VisionTrack** offers a technology to accurately identify the grades of durian, hence providing a proper grading system for the fruit.

# Tapway VisionTrack for Durian Grading

Tapway VisionTrack is an end-to-end visual inspection platform designed to accelerate customised object detection and image classification model development while achieving ultra-high accuracy.

It detects durian by placing six different cameras to capture different angles of the durian. By leveraging an AI model, we can identify individual segments of the fruit, such as:



Full Segment



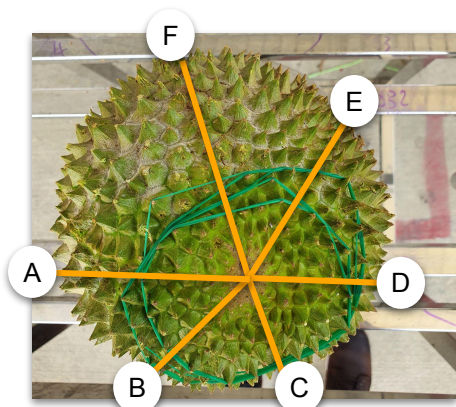
Half Segment



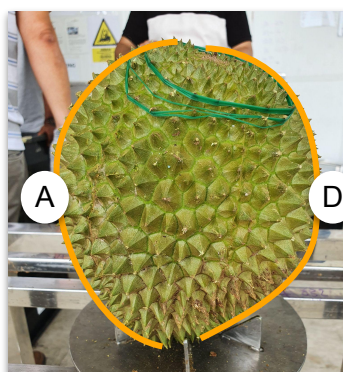
Empty Segment

To predict the accuracy of segments, one camera is placed on a top looking down position, meanwhile, the other five fixed cameras are placed on the side. This is also to identify exactly the angle and the relation between different cameras.

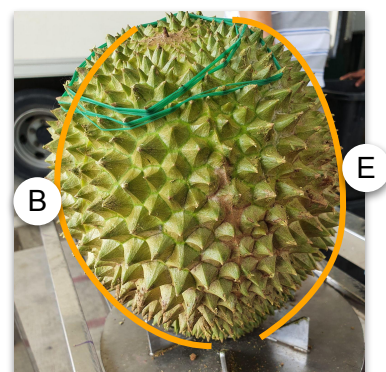
Firstly, to detect the number of segments from the top view, the star pattern at the bottom of the durian must be observed as it can clearly provide information about the segment's line whereabouts. The durian will be placed on a plane to be observed. By imposing fixed angles and the relation between cameras, we can identify which segment line relates to the segment provided in the picture below. As easy as ABC, just by repeating the same process, the final result can be computed. The five fixed cameras are to predict if a segment is full, half, or empty.



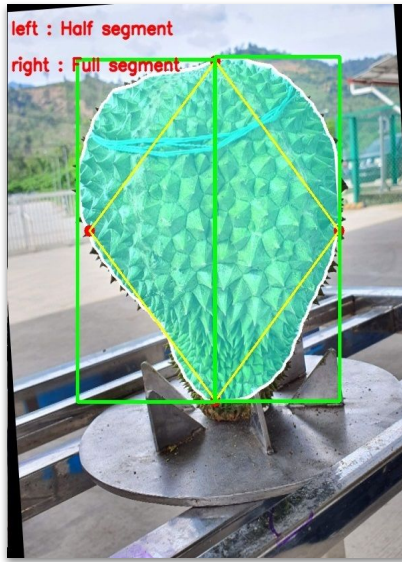
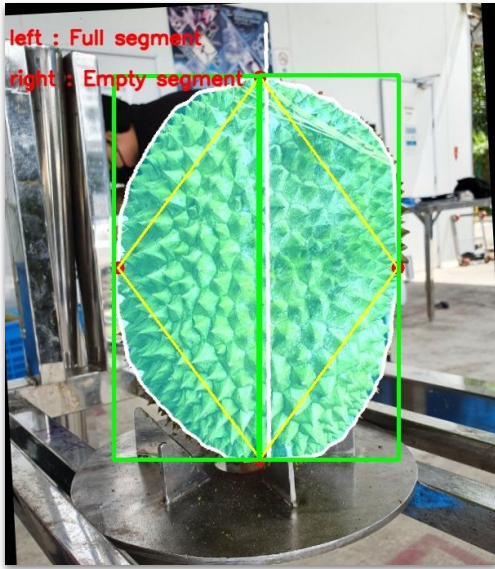
Top View



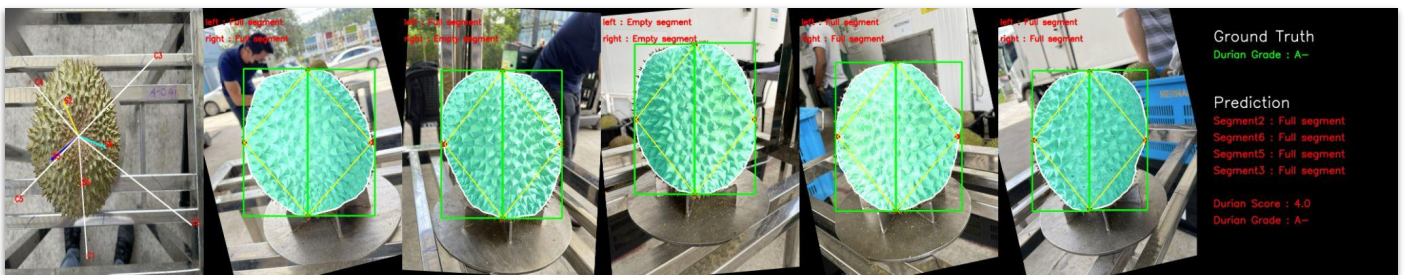
First Image



Second Image

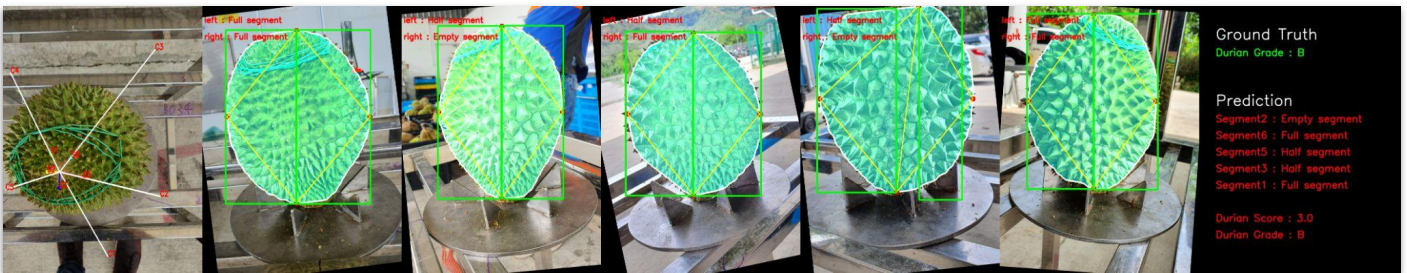


Thus, we can view the output of the final grading. To visualise, the picture below showed durians with 4 Full segments that are graded as an A-, B and B- class. Once the durian's grades are determined, a conveyor belt will automatically transfers and segments the durians into each of its class and the process will be completed.



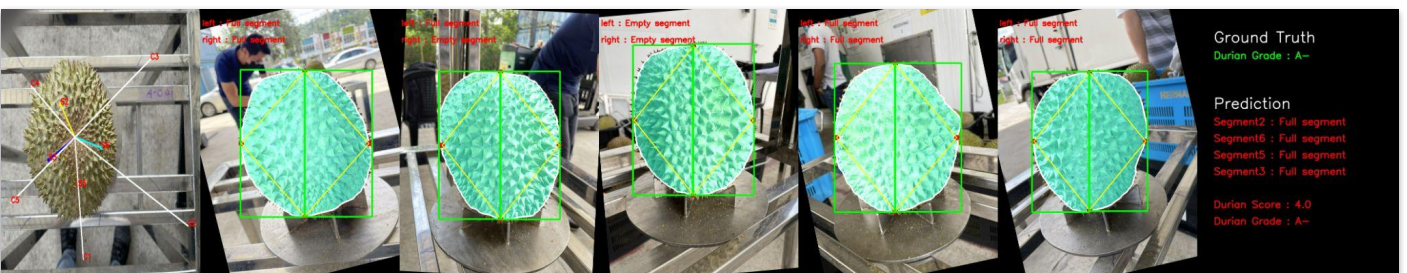
Ground Truth  
Durian Grade : A-  
  
Prediction  
Segment2 : Full segment  
Segment6 : Full segment  
Segment5 : Full segment  
Segment3 : Full segment  
  
Durian Score : 4.0  
Durian Grade : A-

Grade: A-



Ground Truth  
Durian Grade : B  
  
Prediction  
Segment2 : Empty segment  
Segment6 : Full segment  
Segment5 : Half segment  
Segment3 : Half segment  
Segment1 : Full segment  
  
Durian Score : 3.0  
Durian Grade : B

Grade: B



Ground Truth  
Durian Grade : A-  
  
Prediction  
Segment2 : Full segment  
Segment6 : Full segment  
Segment5 : Full segment  
Segment3 : Full segment  
  
Durian Score : 4.0  
Durian Grade : A-

Grade: B-

# Benefits

Tapway's VisionTrack helps to automate grading durian in an accurate manner so that produce is delivered faster, fresher, and more sustainably to consumers.



## Creates a Non-Biased Grading System

With an accurate grading software, durians can be graded swiftly and in a non-consuming manner such as 30 durians per minute, which is 2 seconds per durian. This **eliminates the risk of grading errors** due to manual labour.

## Reduces Low-Skilled Manpower

**Automation makes labour much more efficient** where the workers do not have to fully rely on experts to determine the durian's grades. Even if the experts are not available, the workers are able to grade.



## Operates 24 Hours

Unlike human grader which has limits on working hours and exhaustion, this tool is able to operate all the time, **ensuring high demands can be met on time** as generally, grading can take a long time.

## Tool for Proper Grading

Earning customers' trust with honesty by letting them pay for the real insights of the goods received will make business much more efficient. Proper and accurate grading **eases up the process of tallying with each grade's price.**



# Summary

Malaysia's agricultural pride, durian, is one of the industries that receive high demands from the SouthEast Asia countries like the neighbouring country, Singapore. However, there are hardships for this industry to continue growing such as manpower shortage, high maintenance of durian trees, and most importantly, no proper grading system that makes it difficult to set the standard for the price. **Tapway VisionTrack** offers accurate and automated grading system is finally possible in the industry. With VisionTrack, the business will be more efficient and productivity can be boosted without affecting the production rates.

# About Tapway

Tapway leverages the power of AI Vision and Big Data technologies to transform the physical world through automation. The Company provides a platform to build, train, deploy and monitor AI Vision technology solutions in physical spaces to help businesses eliminate low-skilled manual labour, improve service quality & experience, and enhance safety and security.

## Tapway Solutions



PeopleTrack



VisionTrack



VehicleTrack



LocateTrack

To learn more about our power of AI Vision and Big Data technologies to deliver smart automation solutions that help eliminate repetitive manual labor, maximize efficiency, improve quality and grow revenue, contact us today.

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