Classification of Watermelon's Inner State Based on Hitting Sound Using Machine Learning

Lim, Gaeun (School: Incheon Academy of Science and Arts)
Tae Yoon, Lee (School: Incheon Academy of Science and Arts)

Fruit with good-quality means fruit with appropriate sugar contents and fine texture. Among a variety of fruits, watermelon has a special method of sortation. It is believed that we can sort watermelon by its hitting sound. This fact is widely known. However, nothing is known about its scientific basis. The purpose of this project is to explain the watermelon sortation scientifically and build a program to classify watermelon’s inner state based on hitting sound. We classified the watermelon’s inner state into three categories. ‘Unripe’, a state that has a low sugar content, ‘Ripe’, a state that has optimal texture and taste to eat, and ‘Overripe’, a state that has a inferior quality in skin’s elasticity and pulp’s texture. First, the physical characteristics of these three internal states and the acoustic characteristics of the hitting sound of the watermelon in each state are extracted from the data. We found that thickness of skin decreases as watermelon ripens, and duration of hitting sound increases as watermelon ripens. A hypothesis about the correlation between physical and acoustic properties is established: As thickness of skin increases, duration decreases. It is verified experimentally and analyzed physically, using damped oscillation model. Finally, we create a model that classifies the internal state of the watermelon based on the acoustic properties of each state. The model classifies watermelon’s state with over 95% test accuracy. Using this model, we made program to find good-qualitied watermelon when user record it’s hitting sound. Through this study, it is expected to provide the public with a way to classify the internal state of watermelons non-destructive, economical, and accurate. This will help consumers trust the quality of watermelons.

Awards Won: