

## Evaluation of shelf-life of tomatos – comparison of different evaluation methods

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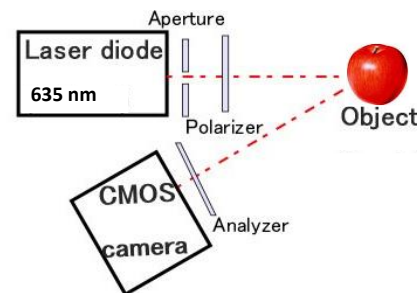
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### Introduction

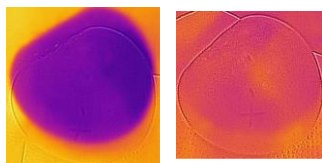
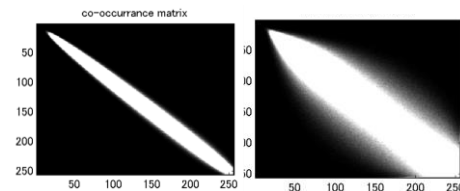
In this paper, we have applied non-invasive optical methods of biospeckles for evaluation of freshness of tomatos stored at room temperature. Biospeckles are formed when a biological tissue is illuminated by monochromatic light due to scattering by organelles moving within the tissue. We have employed Optical Coherence Tomography and Speckle imaging for evaluation along with thermal camera and smell and taste sensor devices. Tomatoes were purchased from a local supermarket and they were spaced every three days.

### Biospeckle and other methodologies

The system with a CMOS camera (1024x1280 pixels) used for speckle imaging is shown in Figure. Speckle images binned to 240 x320 pixels sampled at the rate of 15fps were obtained over a period of 14 sec. A total of three tomatoes with three different points for each one were measured at every 3<sup>rd</sup> day over a period of more half a month. Next speckle images were characterized offline using by different parameters of



cross-correlation between the neighboring frames, co-occurrence matrix and speckle contrast. Based on the analysis, a significant broadening could be seen in the co-occurrence matrix (See figure; left: recent and right: old).



These results were correlated with the thermal images shown on the left with the images obtained on the first (left) and fifth (right) days respectively. We also conducted smell by e-nose and taste measurements in addition human sensing evaluations.

### Fourier OCT

A spectral domain OCT (SD-OCT) system using a superluminescent diode (SLD) centered at wavelength 836.1 nm and a bandwidth of 55.2 nm containing a line scan CCD camera with 2048 pixels was used. The axial and lateral resolutions of the OCT system were estimated to be 6  $\mu\text{m}$  and 22  $\mu\text{m}$ , respectively. The spectral imaging data were acquired through an image grabber while laterally scanning the sample surface by galvano mirrors. Hundred OCT speckle frames (2048x1024) from a single lateral position were continuously acquired every 500ms and resulting correlation length vs position along depth. We will present the results of comparison of different evaluation techniques at the conference.