USDA Pecan Postharvest – Imaging

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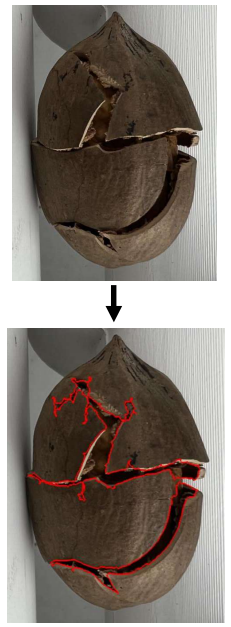
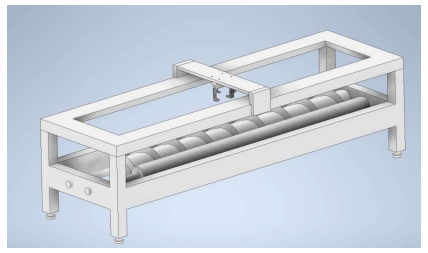
Motivation

- There is a need to measure the efficacy of pecan cracking techniques
- Quantifying cracks on pecans allows researchers to make informed decisions on cracking procedures
- **Image analysis techniques can be used to determine crack metrics**
- Ultimately seek to identify relationship between post-crack statistics and post-shell statistics

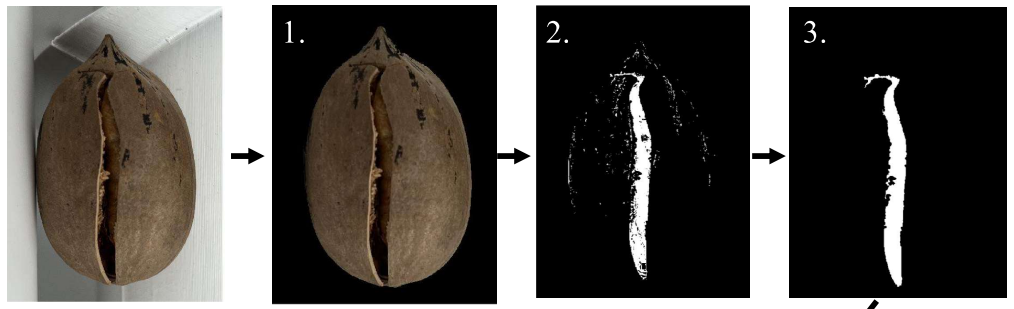


Imaging Equipment

- To see full view of pecans, we need to rotate pecans
- Video footage taken of cracked pecans as they pass through system
- Low throughput system designed to optimize accuracy for experimental data collection



Imaging Workflow



1. Mask pecan from raw video
2. Detect cracks using image analysis
3. Remove noise and fill in crack
4. Determine crack statistics

- Input: raw video of rotating pecans
- Output: $N \times 1$ cell array
  - N = number of indexed pecans in video
  - Each cell contains $x \times y \times K$ logical array (1 = crack, 0 = no crack)
    - x, y = number of pixels in each dimension
    - K = number of disconnected cracks on pecan

Crack Classification

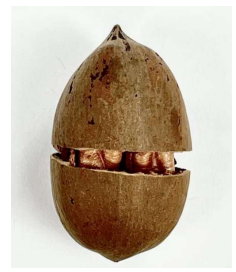
- Cracks are separated by crack type for determination of crack statistics and for further validation

Longitudinal

Entire crack visible in one frame of video

Circumferential

Connects to itself around circumference



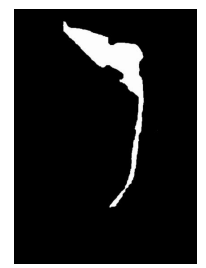
Hybrid

Partial circumferential and branched cracks

Crack Validation

- Further denoising
  - If indexed crack is only present in two frames or less, it is discarded as noise
- Crack classification and frame selection
  - classify cracks as longitudinal, circumferential, or hybrid
  - If longitudinal, additional step needed to identify most direct view

Raw image



Actual crack

Indexed noise

Uncentered crack

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