MACHINE VISION FOR SEEDLING GROWTH MEASUREMENT

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Problem

Quantification of the amount of substrate growth

• Differentiate between substrate and seedlings
• Substrate; white-ish
• Seedlings; brown-ish
• *How to set a number on these concepts*..?

• Simplification: *What is white is not growth*
Image collection

- High resolution DSLR
- White ring-light
- In sea-water
Examples from the Macrosea sampling program

13. Januar 2017 (0%)
16. Januar 2017 (12%)
20. Januar 2017 (16%)
23. Januar 2017 (61%)
26. Januar 2017 (73%)
30. Januar 2017 (83%)
2. Februar 2017 (84%)
6. Februar 2017 (89%)
User interface
Method

A dedicated application for image processing:

• Allows the user to choose a ROI (region of interest) for further analysis.
• Extracts the selected color plane: Four different colour formats may be selected; RGB, HSL, HSV and HSI. For this task the RGB (Red, Green, Blue) format was selected.
• Displays the histograms for the selected colour format.
Method

• Results can immediately be visually checked on the right side of the user interface
• Three images (one from each colour channel: e.g. R, G and B) are then converted into a binary image, using the selected thresholds
• Each binary image is treated using morphological operators: Erosion and dilation
  • Erosion: Shrinks objects and removes noise
  • Dilation: Expands objects, fills holes, smoothing
Method

BW image from Blue channel:

Binary image from thresholding:
Method

• Binary images consists of 0 and 1's
• The growth is calculated using the ratio of 1's to total no. of image pixels
• The threshold level gives the growth and should represent it accurately

• Binary images are displayed, along with the "% growth"
• One of the results is selected (the most representative) and stored in a file along with image name
Method
Method
Results, sampling program
Considerations

TECHNICAL
- Will reach saturation when no substrate pixels are visible
- Uses 2D images: Seedlings grow in 3D and may cover substrate pixels slightly (light brown), or heavy (dark brown)
- Solution: For image analysis of larger seedlings, total image brightness might be used
- Combination of >1 channels might be used for better thresholding

PRACTICAL
- May be used as a tool for quality control at large-scale hatcheries
- Variations we observed may have several causes;
  - Genetic diversity
  - Uniformity of lab conditions
- We are redesigning the lab for more uniform conditions
Technology for a better society