



A New Image Acquisition System Building 3D Model of Skin and Its Application

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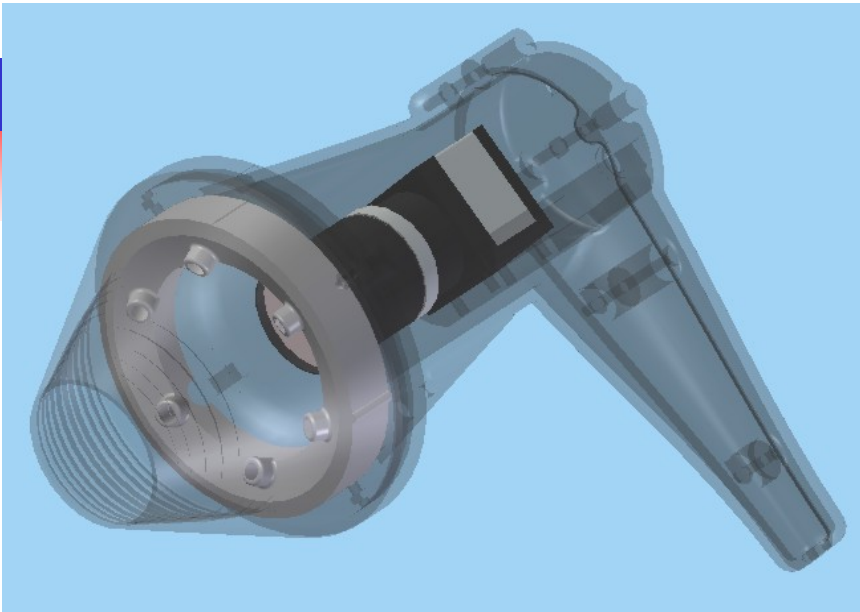
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The Skinmetrics Device



Height: 26.5cm

Length: 19.0cm

Width: 9.0cm



Outline

- **Background**
- **Motivation**
- **How to build the device**
- **How to use the device**
- **How does the device work**
- **Application**
- **Conclusion and discussion**



Background

- **Melanoma is a fatal skin disease.**
- **If it can be detected earlier, the patient would have more chances to survive.**
- **In pigmented lesion clinics, lesion inspection is largely a subjective and repetitive process.**



Motivation

- For plastic surgeons, this device is designed to assist clinical lesion inspections.
- For patients with suspicious lesions, this device gives them more chances to detect fatal lesions earlier.



How to build the device

- **Camera**
- **Lens**
- **Light sources**
- **Accessories**



How to use the device

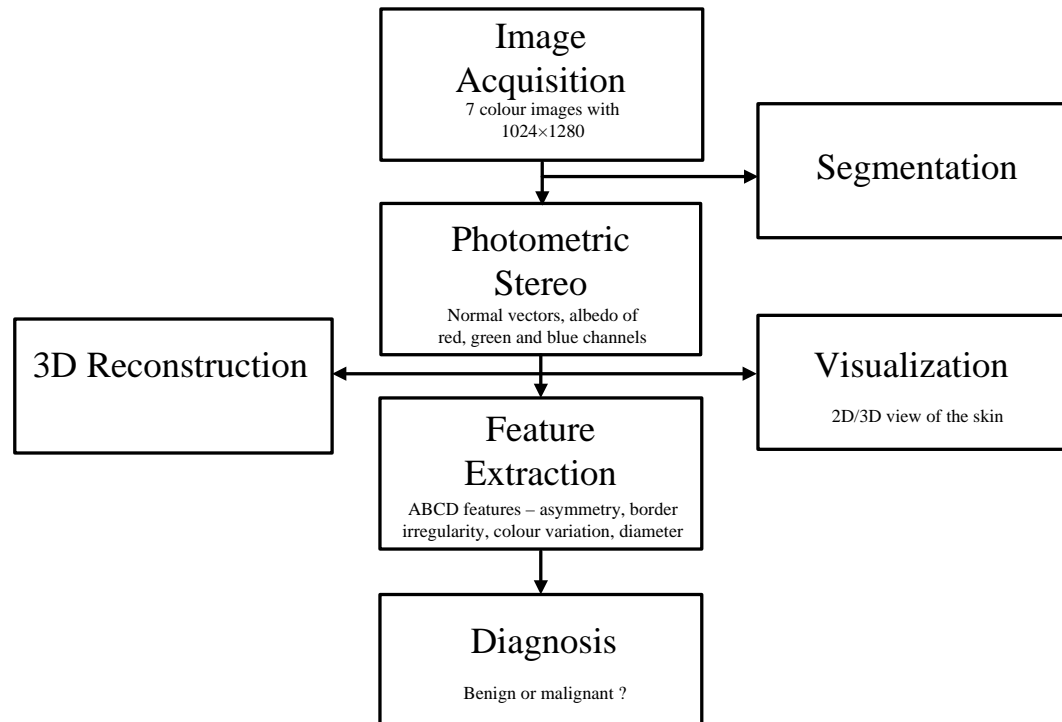




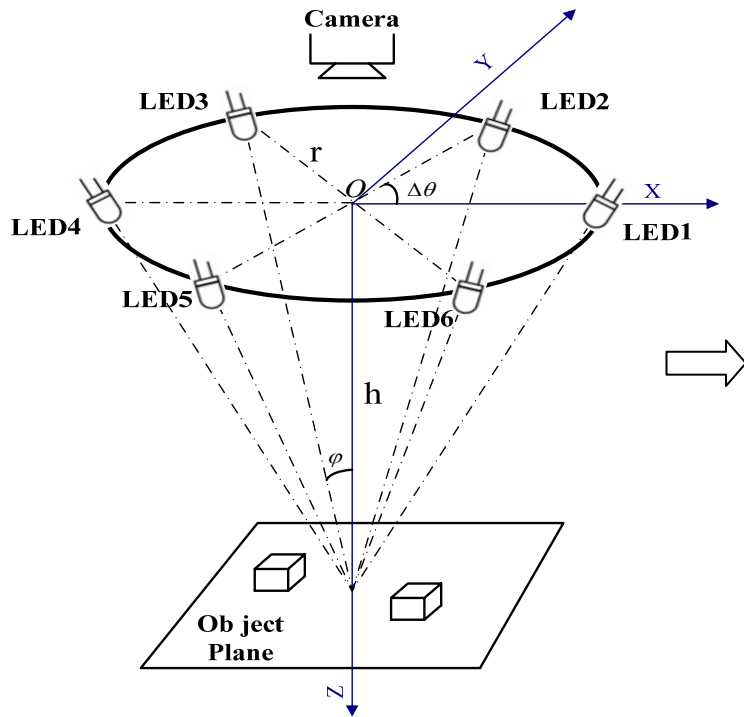
How to use the device

- Set it up properly
- Run the software
- Make sure the object is in focus
- Press the button on top of the device
- Processing in progress

How does the device work (1) - Flowchart



How does the device work (2) – Image Acquisition



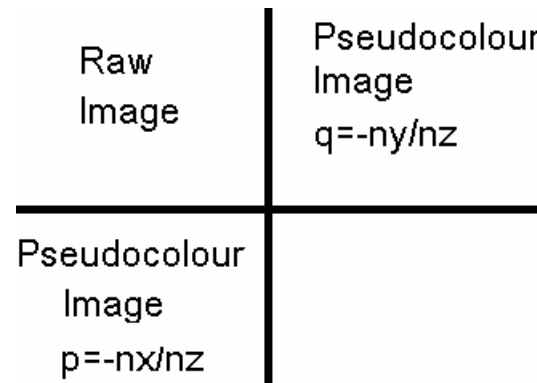
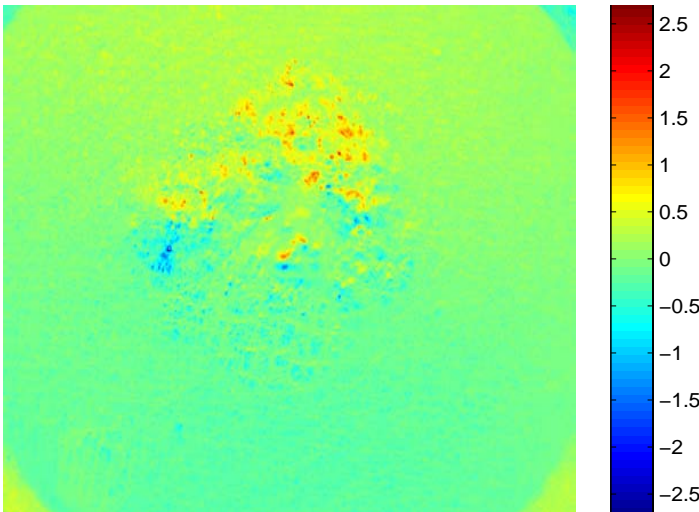
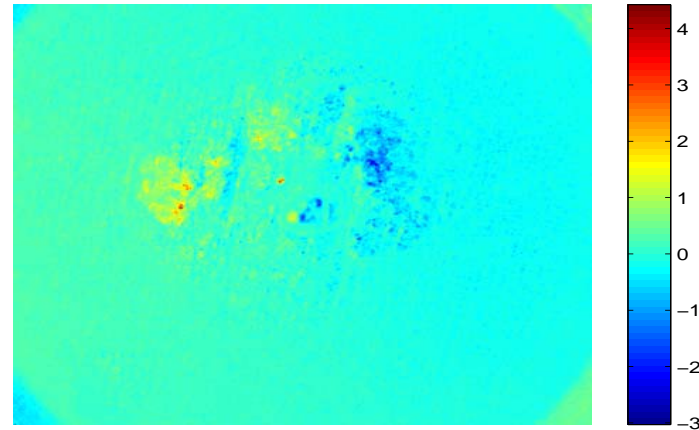


How does the device work (3) – Photometric Stereo

■ Photometric Stereo

$$\begin{bmatrix} L^{1T} \\ L^{2T} \\ L^{3T} \\ L^{4T} \\ L^{5T} \\ L^{6T} \end{bmatrix}_{6 \times 3} \begin{bmatrix} n_x \\ n_y \\ n_z \end{bmatrix}_{3 \times 1} \begin{bmatrix} \alpha_R & \alpha_G & \alpha_B \end{bmatrix}_{1 \times 3} = \begin{bmatrix} I_r^1 & I_g^1 & I_b^1 \\ I_r^2 & I_g^2 & I_b^2 \\ I_r^3 & I_g^3 & I_b^3 \\ I_r^4 & I_g^4 & I_b^4 \\ I_r^5 & I_g^5 & I_b^5 \\ I_r^6 & I_g^6 & I_b^6 \end{bmatrix}_{6 \times 3}, \quad \left\| \begin{bmatrix} n_x & n_y & n_z \end{bmatrix} \right\| = 1$$

How does the device work (4) - Normal Vector



Application (1) - Visualization

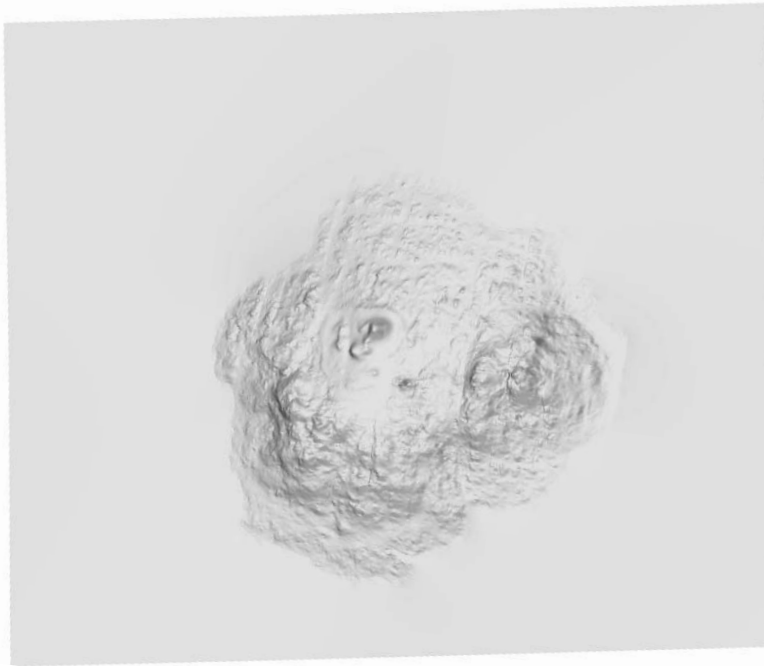
- Bumpmap Generation



bumpmap_brighter.avi

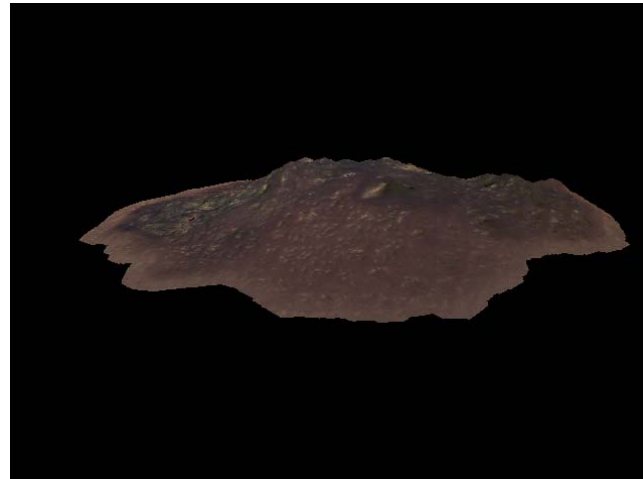
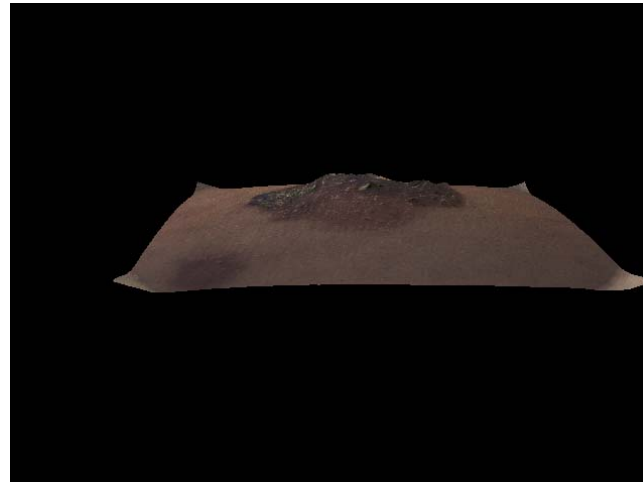
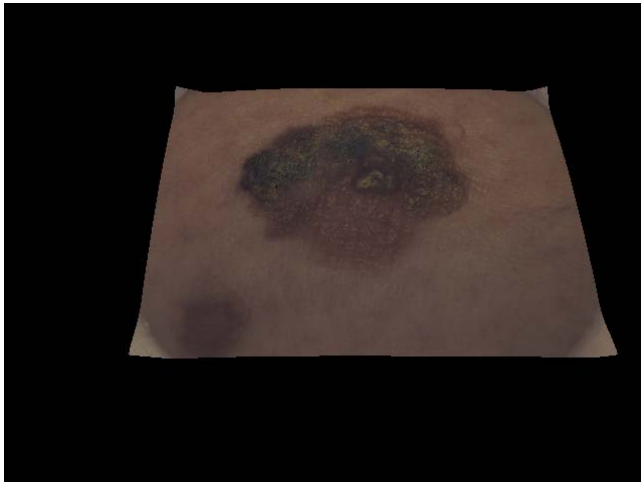
Application (1) - Visualization

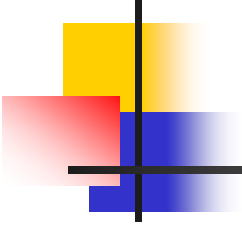
- 3D Rendering



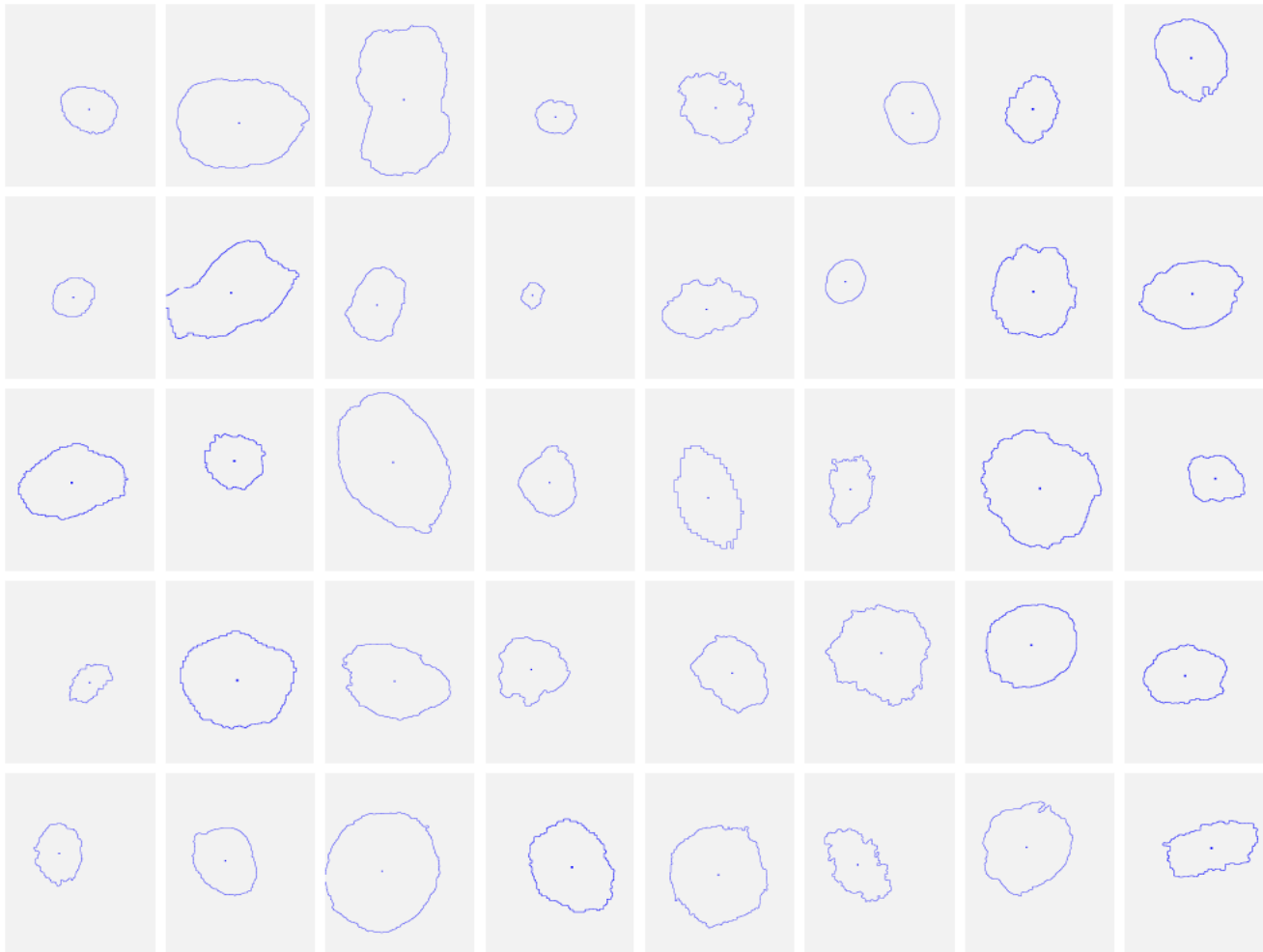
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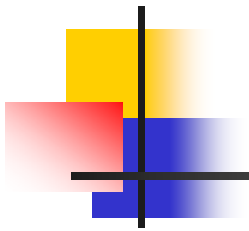
Application (1) - Visualization



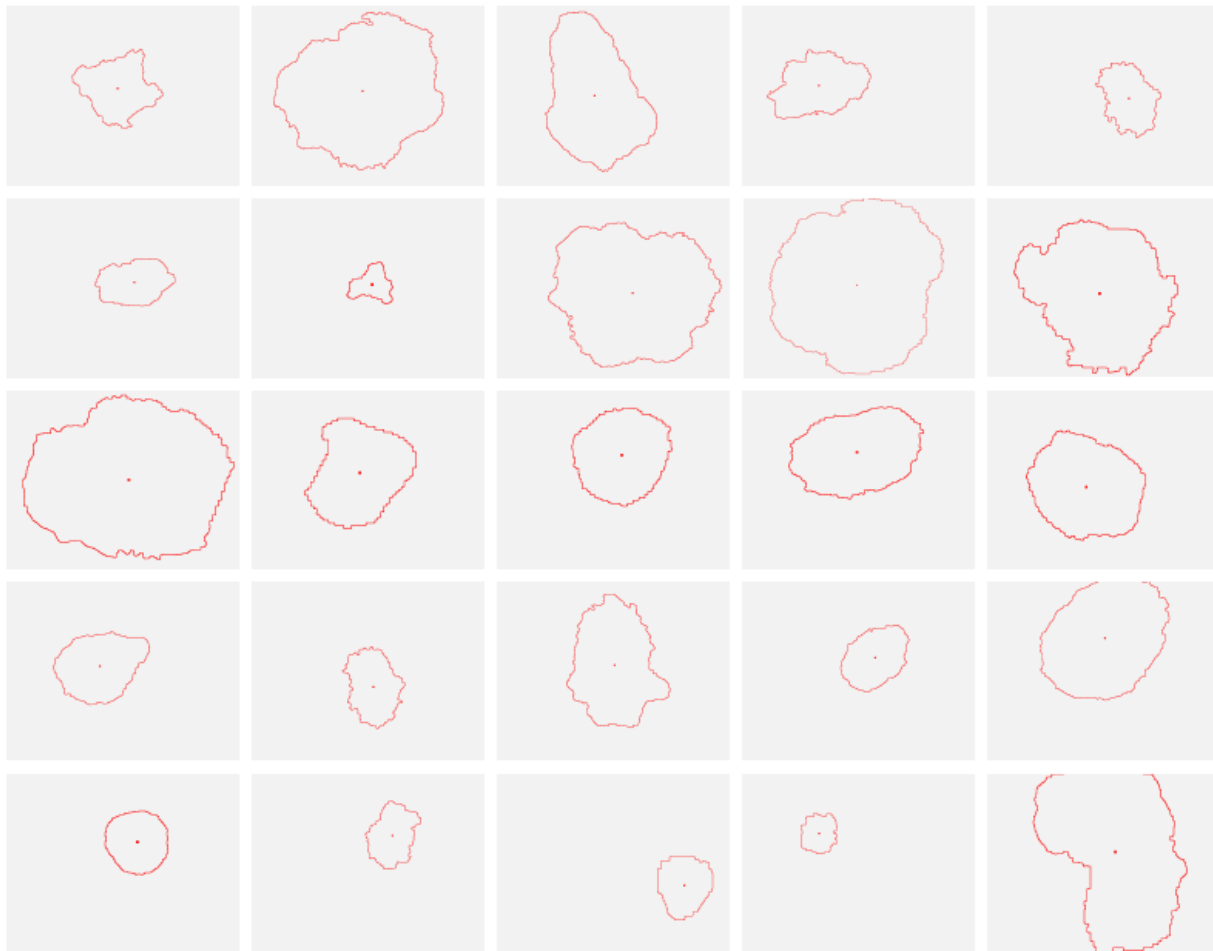


Application (2) - Segmentation

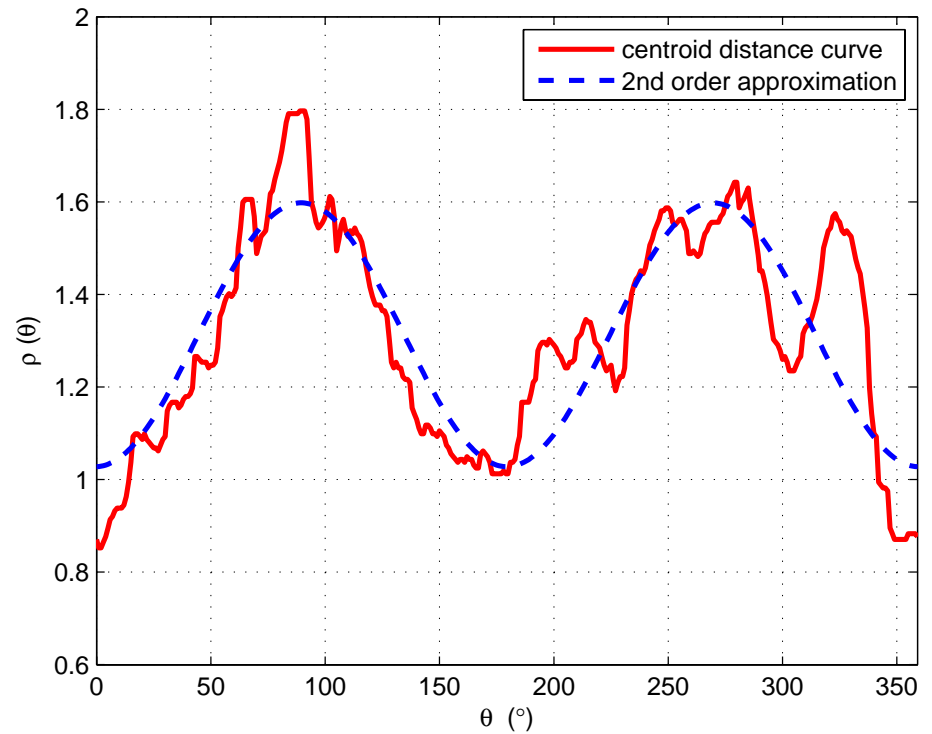
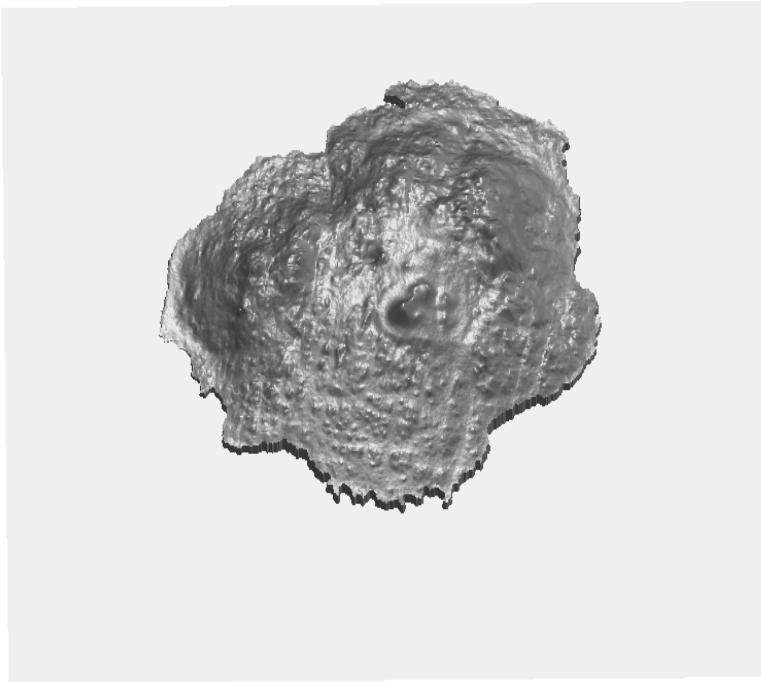




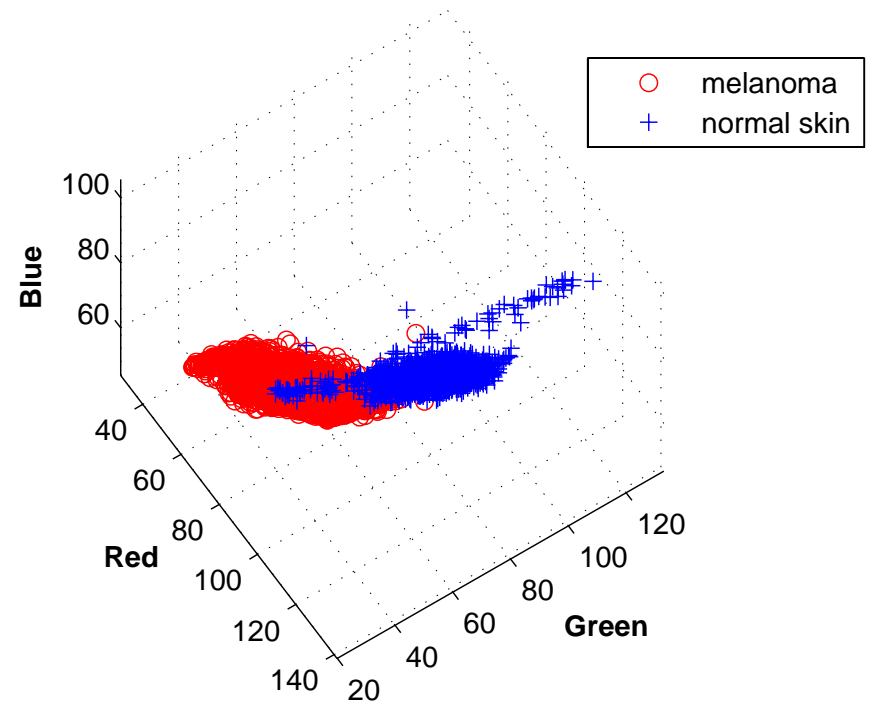
Application (2) - Segmentation



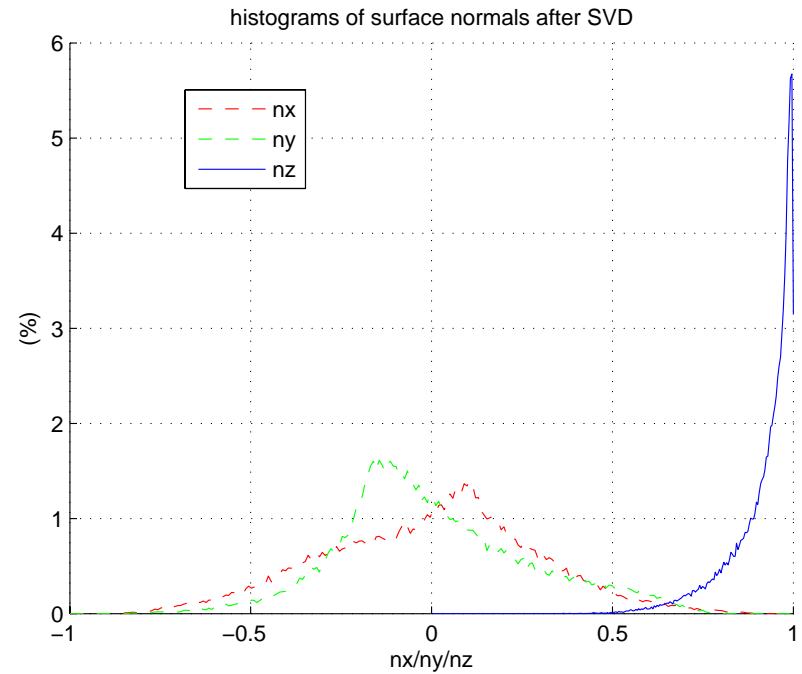
Application (3) - Feature Extraction



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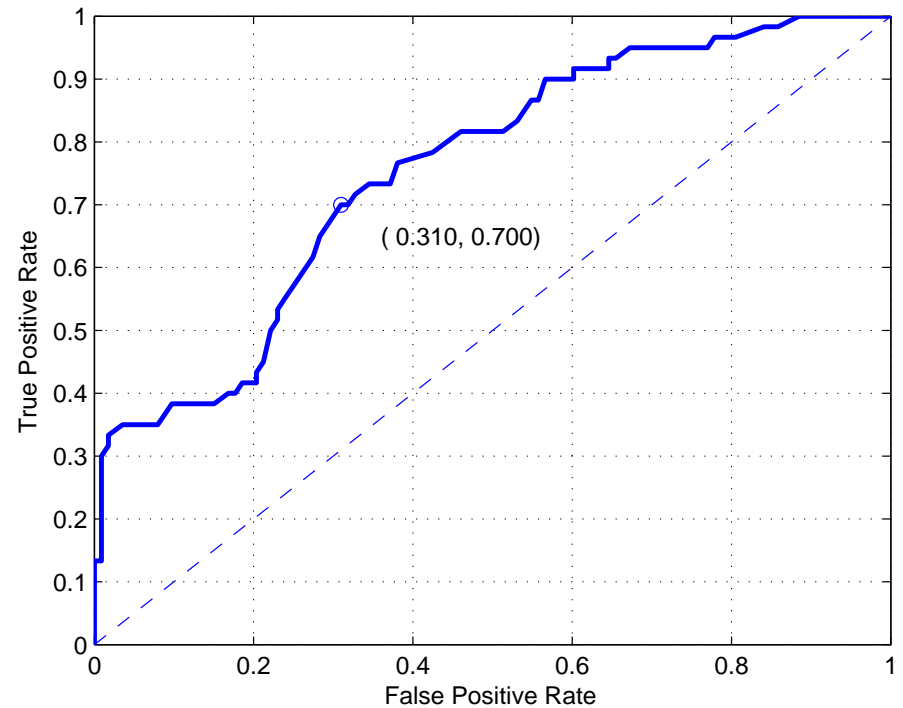
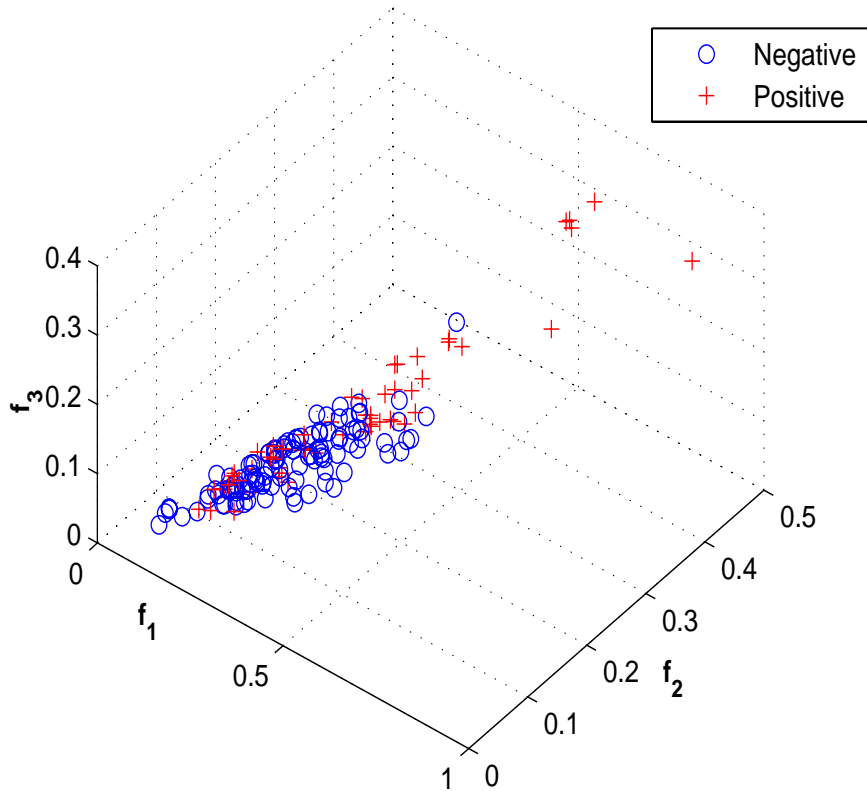
Application (3) - Feature Extraction



Application (4) - Database



Application (5) - Diagnosis





Conclusion and Discussion

- **This device offers a new dimension in describing pigmented lesions.**
- **Further challenges will generate more solutions.**
- **Techniques developed in designing this device might be extended to apply to other surface inspection areas in clinic or industrial environments.**



The End

Thank You!

For more information, see

<http://www.uwe.ac.uk/cems/research/groups/mvl/index.html>