SKIN LESION CLASSIFICATION USING LIGHT-FIELD IMAGING

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Abstract

Accurate early detection of suspicious skin cancer is highly critical. Computer vision techniques can be used as part of the diagnosis process increasing the sensitivity, but lead in many cases at the cost of specificity. The balance between both is fundamental, which can be improved through extraction of new features, such as 3D lesion information obtained from a newly contactless light-field dermoscopy technique, and using Artificial Intelligence to achieve a high classification accuracy.

Current State-Of-The-Art (Dermoscopy)

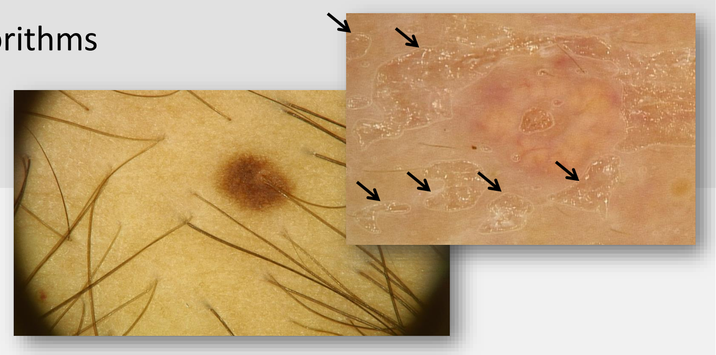
Light Intensity

Image Acquisition

- Medical imaging provided 50% diagnostic accuracy increase in the medical industry
- Commonly used
- Simple hand-held camera

Pre-Processing

- Complex artifact removal process sometimes requiring inpainting algorithms
- Dermatoscopy is prone to the existence of air bubble artifacts
- Hair removal require complex algorithms
- Adds artificial border to images

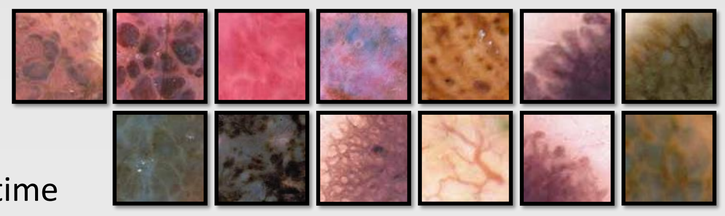


Segmentation

- Blurred transitions between the lesion and healthy skin are hard to discriminate
- Non-trivial task, requires texture knowledge

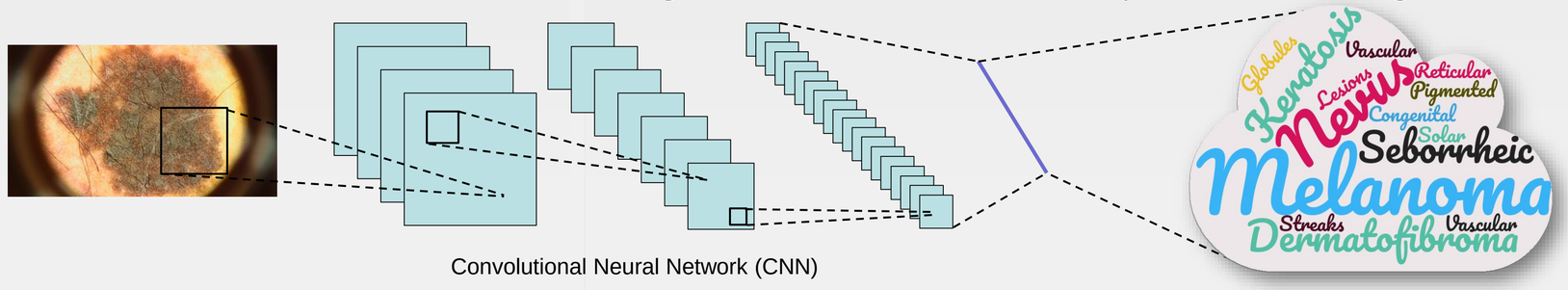
Feature Extraction

- Texture recognition
- Structural information
- Color information
- 2D border deformation over time



ML Classification

- Clustering
- Traditional Machine Learning
- Feature Transformations
- Neural Networks and Belief Systems
- Deep Learning

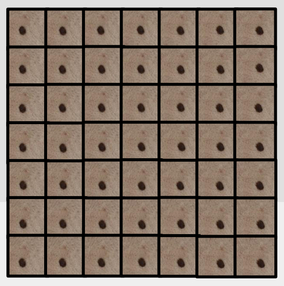


Convolutional Neural Network (CNN)

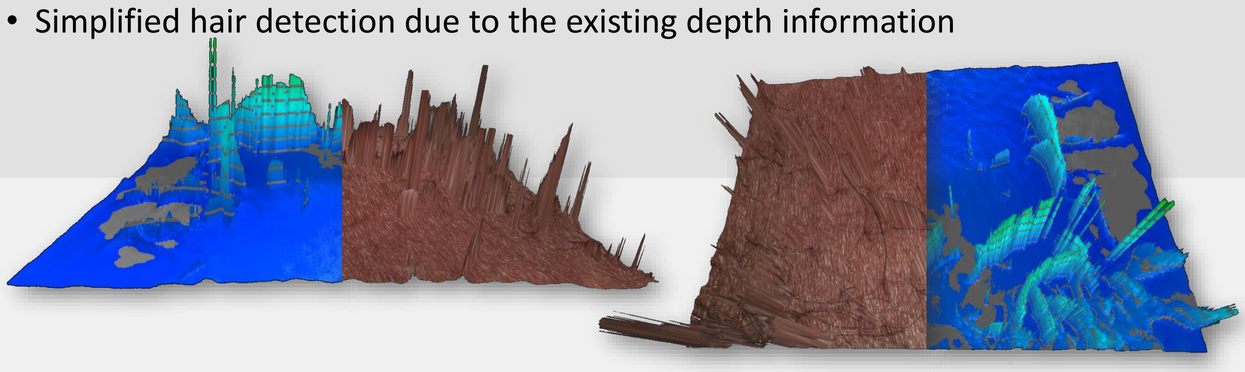
Proposed Approach: Light-Field (3D)

Light Intensity +Light Ray Direction

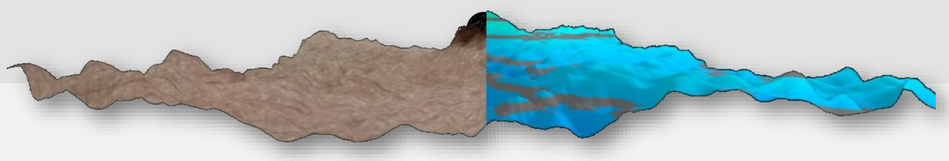
- Allows macro visualization and later refocus and perspective adjustments
- Emerging field of application
- Simple hand-held camera



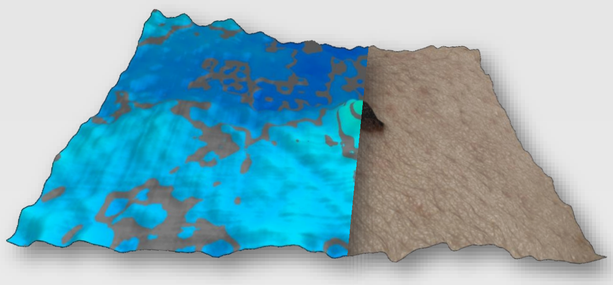
- Instead of generating artificial information through inpainting, removed hair can be replaced by real information from adjacent views
- Simplified hair detection due to the existing depth information



- Most lesion boundaries can be found by its abrupt ledge



- The previously existing features
- New dimension of information (3D)
- 3D evolution over time
- Multiple views of the same lesion



- Empowered classification with new (3D) features
- Augmented information from multiple views of the original lesion

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