BACK ATLAS FOR TRACKING PIGMENTED SKIN LESIONS

Hengameh Mirzaalian¹,², Ghassan Hamarneh¹, Tim K. Lee¹,²,³

¹Medical Image Analysis Lab, Simon Fraser University, BC Canada; ²Photomedicine Institute, Department of Dermatology and Skin Science, University of British Columbia and Vancouver Coastal Health Research Institute, BC Canada; ³Cancer Control Research, BC Cancer Agency, BC Canada.

Tracking pigmented skin lesions (PSL) is commonly performed for high risk melanoma patients. Patients are photographed to allow physicians to periodically compare the images taken at different times in order to detect changes in the number of PSL and their appearance. Recently, we initiated a study to automate the tracking of PSL from images of human backs.

In computer vision, the state-of-the-art approach for comparing images is to perform spatial normalization by warping images into a common coordinate frame of reference, an atlas. As an example, a brain atlas allows us to compare data from different subjects or from the same subject taken at different times. Inspired by such works, we propose the first atlas of the human back, which is a unit-square patch with a set of longitudes and latitudes anchored by anatomically meaningful landmarks. Back images taken at different times are also divided into grids of longitudes and latitudes. Then, the grids along with PSL are warped to the proposed atlas, where matching is performed.

We evaluated our back atlas by registering 56 pairs of back images using several PSL matching algorithms with and without an atlas. Our experiment showed that the anatomy-based atlas improved the matching accuracy by 2% to 50%.

Clinical Significance and KT: Automating the tracking process can help detect changes in PSL, which is critical for early detection of potential malignancies. In this applied experiment, we proposed the first human back atlas and showed that it could substantially improve the matching accuracy of PSL.
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\textsuperscript{1}Medical Image Analysis Lab, Simon Fraser University
\textsuperscript{2}Skin Research Training Centre, Department of Dermatology and Skin Science, University of British Columbia

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Introduction

- Density of moles is a strong predictor of malignant melanoma.
- Periodic full-body scan for high-risk patients.
- Compare different time instances to recognize changes.

**Figure**: Intra-subject image samples.
Introduction

- Automatic tracking of corresponding moles would have significant health benefits.
- Comparing the spatial location of moles is important.
- Naive alignment of images give erroneous results.
Automatic tracking of corresponding moles would have significant health benefits.

Comparing the spatial location of moles is important.

Naive alignment of images give erroneous results.
Automatic tracking of corresponding moles would have significant health benefits.
Comparing the spatial location of moles is important.
Naive alignment of images give erroneous results.
Problem

- Simple Example:
Problem

- Simple Alignment (.avi):
Problem

- Rotate and Align:
Problem

- More complicated cases due to growth:
The first human back template

- Alignment must correspond homologous locations in an anatomically meaningful way
- A Non-Rigid Alignment is needed.
The first human back template

- Alignment must correspond homologous locations in an **anatomically meaningful** way
- A **Non-Rigid Alignment** is needed.
The first human back template

- We align all images non-rigidly to a template back image.
Steps of warping the grid (.avi):
Proposed Back Template

- Landmarks:

- Overlaid grid:
Proposed Back Template

- corresponding cells with similar colors:
Normalized coordinates
Graph Based Mole Matching

[Graphs and diagrams related to mole matching]
56 pairs of real dermatological images
Clinical Significance and Knowledge Translation

This study can be classified as early experiments.
Acknowledgements
Thanks :)}
Graph Based Mole Matching
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Graph based mole matching
Graph Based Mole Matching

- Matching Cost function:
  - Length agreement
  - Angular agreement
  - Agreement between the moles normalize coordinates
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