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Practices on Visual Computing I - MetaOptima Collaboration

Temporal Change Detection of Lesions on a Full-body Image

Description

MetaOptima is in the business of improving the efficiency and effectiveness of the day-to-day practice of Dermatologists. One of our key features is our Total Body Photography module. This software package offers a suite of tools to help manage full-body images of patients over multiple visits.

The tools include:

- A *Detection* module which uses object detection to annotate lesions on a patient's body
- A *Matching* module which creates a correspondence between detected lesions on two different images of the same patient in a similar pose taken at different times
- A *Change Detection* module which attempts to prioritize lesion matches based on how much we feel they have changed over time.

Change detection is both a valuable efficiency tool for practicing doctors, as well as a critical tool to detect new or changing lesions, which is a predictive feature in the early detection of Melanoma.

Students will be provided with some background information to help situate them in the space, along with our current solution to change detection to use as a baseline. Since patient data is sensitive, students will be working with image crops from full body images.

We expect that students will start with some data exploration to understand the state of our data set, along with a review of the documentation which we are able to provide. We then expect that students should conduct a thorough literature review to determine what kinds of suitable methods might be applied to this problem space. Finally, we expect students to produce a prototype solution using a recent method from the relevant literature, and to benchmark its performance against our baseline results.

Students should produce a final slide presentation for stakeholders to help us understand what they have done and learned during the project.

Ideally, students should aim to use commercially available open source software.

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Datasets

Students will be provided with a data set of matching lesions with associated labels detailing “how changed” we believe the lesion pair to be. These labels were collected in-house by a team of 5 independent reviewers. The labels are categorical from 0-5, detailing how many individuals believed that the pair of lesions had changed over time.

Each set of matching lesions will also come with a set of image crops at multiple sizes, center cropped around the lesions. Corresponding image crops (belonging to the same lesion-match) will have each been cropped from a different image taken during a different dermatologist visit for that patient. We are happy to provide crops at multiple sizes to allow for more contextual information, should students choose to use it.

Each lesion match will also have some associated metadata to give more context, such as unidentifiable patient information, and lesion information such as the coordinates from which the lesion was cropped.

We are also happy to provide *predicted* segmentation masks for the crops as well.

Compute

Students will be provided with an SSH key along with VPN access to one of MetaOptima’s in-house consumer-grade machines. This machine will be running a recent installation of Ubuntu, and will have 2 consumer-grade GPUs (10/2080Tis), and at least 32 GB of RAM.

Challenges

The data set consists of somewhere on the order of 10,000 labeled matching pairs of lesions, which is on the smaller side these days. This means that some data augmentation or semi-supervised learning techniques might be appropriate. We could also provide an additional set of ~50,000 unlabeled, matching pairs of lesions if students intend to use semi-supervised learning techniques.

The labels are imbalanced in favor of unchanged. This should be expected, since change across visits for a lesion is somewhat rare being that it is predictive of melanoma. This data imbalance is fairly strong.

Change is a difficult thing to label, and as such these consensus labels are somewhat more noisy than they might be for other tasks such as classification.

Contact Person

William Yolland, R&D team lead. William will help you to get started during the first week of your project, and can provide 1 weekly meeting of a maximum of 2 hours to help during the project.