

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
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S2-19_DSECLZG628T PROJECT WORK
Project Work Outline

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Title of Project Work: Skin texture change detection for clinical trials

Name of First Examiner:

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Supervisor's rating of the Technical Quality of this Project Work Outline

EXCELLENT / GOOD / FAIR / POOR (please specify): EXCELLENT

Supervisor's suggestions and remarks about the outline:

*Great start! The outline looks good.
Please keep the momentum high and report
the progress regularly.*

V.N.K. Ch. S. Sarma
(Signature of Student)

Date: 02/10/2020

S.V.K. Tejasvi
(Signature of Supervisor)

Date: 02/10/2020

Dissertation Topic: Leveraging Computer Vision in Retail & Pharma

Dissertation Title: Skin texture change detection for clinical trials

Problem Statement:

The global skin care products market size was valued at 134.8 billion in 2018 and is projected to expand at a CAGR of 4.4% from 2019 to 2025 on account of the rapidly expanding global cosmetics industry. The growing e-commerce sector is anticipated to boost the market growth further. Moreover, technological and product innovations have led to an increased demand for skincare products.

This escalating demand for face creams, sunscreens and body lotions across the globe is pushing manufacturers to spend more time, money and resources on research and development. To target global markets, clinical trial participants are chosen from various demographics including age, location, ethnicity and skin types. Huge amounts of images get generated during the course of each trial, which are analyzed by the clinicians to note the efficacy of each chemical/product.

These industries are also bound by confidentiality agreements with the participants which demands protection of PII data.

Existing system:

To protect PII data, image masking softwares are used to cover some facial parts of the participants however, the licensing costs become a burden very soon. Moreover, manual observation of skin changes such as wrinkles, blemish etc by a clinician over such a large volume of images is time consuming and error prone.

Solution:

Build automated solution to mask facial parts (which need not be analyzed) for protecting identity of the participants. Use computer vision algorithms to detect changes in skin texture and provide insights to the clinicians to better understand the efficacy of the products.

Scope of work:

The scope of work will involve understanding the design and other requirements

- Explore the machine learning and deep learning techniques for image masking
- Experiment with various Computer Vision algorithms for texture analysis
- Design the solution in cloud to meet the algorithm and visualization requirements

Methodology:

1. Clinicians to upload the raw images to cloud storage
2. Mask the images instantly and delete the original images
3. Apply computer vision algorithm to perform texture analysis on facial images
4. Build visualizations for the clinicians to better understand the efficacy of the products

Uniqueness of the project:

This is an end-to-end solution rather just a portion of what is expected by the industry. The following modules form the entire solution:

- Data engineering: Gathering, storing and masking of data
- Data Science: Applying Deep Learning and Computer Vision algorithms to generate insights from image which are helpful for research
- Operationalization: Leveraging cloud services to host the entire solution in order to generate repeated value

Benefit to the organization:

The following are the primary benefits:

- Ability to automatically infer the changes in the skin texture, thereby identifying efficacy of each chemical/product being used in the lab
- Compliance with confidentiality agreements with the participants of the clinical trials
- Since no human involvement is needed, scalability in terms of speed, volume and accuracy is a huge benefit.

Potential challenges & risks:

- Gathering huge volumes of images to train the model
- The masking process has to be 100% accurate to stay compliant
- Good amount of testing is needed in skin texture identification as key decisions are taken around the chemicals used in a product

Source:

Since we are not allowed to use the actual images taken in the lab, in order to train/test the algorithm and for user acceptance testing purposes, we will be downloading free image datasets available on ImageNet, Kaggle, Google Images, celebfaces etc to gather a collection of facial images suitable for our use case.

Input/Output Dimensions :

Inputs will be ID, Ethnicity, timing_of_photograph, age, gender and product_under_testing provided as S3 tags associated with facial images of the participants. Output 1 will be Masked images and Output 2 will be histogram for each "region" of an input facial image (no. of regions can be controlled by the user to get higher or lower granular details) to help analyze skin texture (such as wrinkles). Other visualizations according to Ethnicity, age group are being planned.

Feasibility study:

Although lot of aspects of this project are experimental in nature, the planned outcome is certainly possible to achieve as long as we take a controlled and step-by-step approach for the completion of the project.

Resources needed:

Cloud platform, Python, Computer Vision, Machine Learning and Deep Learning packages and good number of images for training/testing

Plan of work:

S.No	Task	Planned duration (in weeks)	Name of Deliverables
1	Research and feasibility check	1	Research
2	Gathering the raw images	1	Data Gathering
3	Setup a cloud platform with storage, compute and software	1	Cloud setup
4	Implement PII data masking	5	Application
5	Implement texture analysis using a computer vision algorithm	5	Application
6	Build visualization showing efficacy of products	3	Reporting

Solution architecture:

