CHAPTER-1

Introduction

1.1 Facial Retouching

In the world of enhancing facial attractiveness, the pursuit of beauty takes shape through three distinct avenues, each wielding its unique methods to transform one's visage. This journey is illuminated in Figure 1, replete with examples showcasing the intricate artistry that underlies these transformations. Given the same objective, it is not wondering that the various forms of beautification result in changes that are related to one another; for instance, a thinner face can be obtained by proper use of makeup, correcting the facial bones, and retouching. The process of changing a person's face in a photo or video using digital editing tools is known as facial retouching. This might involve a variety of changes, including as erasing wrinkles or blemishes, modifying skin tone, altering the size or form of facial features, or boosting specific facial features to give the face a more polished or glamorous appearance. In this digital era, the face images are widely used for different purposes some of them are described as below.

1. As a piece of evidence:

Prior to the issuance of an electronic travel document, many types of image manipulation, including retouching, may be carried out intentionally or unintentionally. The applicant supplies the face image that is utilized to issue the Passport in various nations. Similar to this, now-a-days photo ID is needed to upload as an identity proof for so many legal tasks. Where, applicant is uploading the retouched face image to provide flawless and attractive impression.

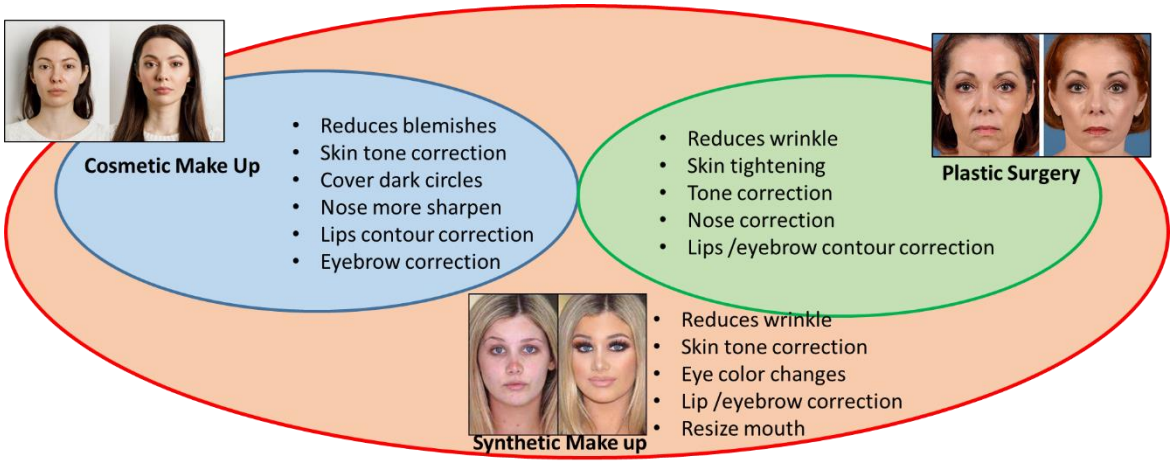

FIGURE 1.1 Examples of different types of beautification[1][2][3]

2. Social media:

As the people are too much attached with the social media, they are uploading the beautified photos over the social media like Instagram, Facebook, telegram or many matrimonial sites, to make the profile more appealing. Fashion industries and advertising agencies use to use the over-retouched photos of celebrities for the profit making. It may perpetuate misleading representations or propagate unattainable beauty ideals, which can have a detrimental effect on society's perception of beauty, self-worth, and body image. If facial recognition software is used on images downloaded from social networking sites like Facebook or Instagram, during a forensic investigation, it is very possible the use of retouching. The reason is photo editing tools are freely and easily available for desktop and in smart phones. Even these tools are user friendly.

1.2 **Motivation**

Image forgery, a digital counterpart to traditional forgery, introduces a complex dimension to the age-old art of deception. In this digital age, the ease of manipulating visual content has given rise to a new form of forgery, where images are altered or fabricated to create a false representation of reality. The motivation behind the endeavour detect and classify facial retouching techniques is rooted in the ever-expanding influence of digital imagery on contemporary society. With the proliferation of photo-editing tools and the widespread dissemination of digitally altered images through various media platforms, there exists a growing concern regarding the authenticity and trustworthiness of visual content. Detecting

and categorizing facial retouching not only serves as a means to maintain the integrity of photographic representations but also addresses issues related to body image perception and self-esteem. Moreover, in contexts such as law enforcement and security, accurate assessment of facial retouching can play a pivotal role in identity verification. By developing robust methods for the identification of retouched images, we aim to foster greater transparency, trust, and ethical responsibility in the digital age while also empowering individuals and organizations to make informed judgments about the imagery they encounter.

1.3 **Definition of the Problem**

This research aims to develop an efficient framework detection and classification of facial retouching using a transfer learning approach entails the development of a robust computational framework to discern subtle alterations made to facial images, with the objective of preserving the integrity and authenticity of visual content. In essence, this problem revolves around the challenge of distinguishing between real facial image and those that have been digitally modified, be it through software photo editing tools. The use of TL (transfer Learning) is motivated from the necessity to leverage the knowledge of pre-trained CNN in other domain to increase the accuracy and efficiency of the the classification task with minimum computational complexity and computational time. A framework like this aims to offer a comprehensive way of identifying retouched photographs, preserving truthful representation in a variety of applications like forensics, image authentication, and media credibility evaluation.

1.4 **Objective and Scope of Work**

The purpose of this work is to investigate the potential role of the transfer learning approach for the detection and classification of facial retouching. The main objectives of this work are listed below:

- To examine state-of-the-art methods and innovative model for classifying the facial

retouching.

- Investigate and implement transfer learning approaches to improve detection and classification accuracy by leveraging pre-existing deep learning models and domain-specific knowledge.
- A comparison of various optimizers used for the detection and classification during fine-tuning to determine the most efficient and effective optimizer for the proposed *TL* model.
- To ensure the comprehensive evaluation of detection and classification model, by incorporate two standard and distinct retouched faces datasets.
- To carefully choose final model to conclude this research based on a thorough comparison of detection and classification performance across several optimizers, varied train-test split ratios, and the use of two separate datasets.

1.5 **Original Contribution of the Thesis**

In this work, fine tuning of transfer learning has been demonstrated to classify the real and fake face images. The original contributions of this research work can be summarized as:

- Development of a novel transfer learning framework, incorporating well-established deep learning models such as VGG16 and ResNet50, specifically modified for the detection and classification of facial retouching. This approach harnesses the strength of pre-existing models to enhance the accuracy and adaptability of the retouching detection and classification algorithms.
- A broad comparative analysis of optimization algorithms like Adam, and RMSprop, during the fine-tuning process, aiding in the identification of the most efficient optimizer for the retouching detection and classification models.
- Evaluation of model robustness under different train-test split ratios, including 50%-50%, 60%-40%, 70%-30%, and 80%-20%, providing insights into performance variations in scenarios with varying levels of training data availability.
- In-depth analysis of facial retouching detection and classification employing datasets with a variety of retouching settings including both balanced and imbalanced distributions of real and fake photos.

- Exploration of retouching methods in-depth, with one dataset devoted solely to photographs modified using a single photo editing tool and another dataset includes fake samples edited with two distinct editing tools.
- The performance of the models are compared and choosen best model for classification task. The classification accuracy and performance parameters of the models are compared to the state-of-the art models.

1.6 Thesis Organization

The rest of the thesis is organized as:
The second chapter is devoted to the state-of-the-art algorithms developed for classification of facial retouching. The work done so far on different beautification types are carried out and reviewed.

The third chapter includes the description datasets used for evaluating the model performance. The data augmentation method and train-test split ratio are briefly explained.

The fourth chapter includes the methodology carried out for classifying the retouching. This chapter explores the transfer learning approach with modified architecture of VGG16 and RsNet50. It includes the training strategy and hyper parameter to be set for training the models.

In the fifth chapter, the experimental set is broadly explained. The performance parameters are described for evaluation of different models.

The sixth chapter includes the result analysis for each combination of model and optimizers. It includes the analysis of the impact of different train-test split ratio for both datasets for model performance.

Finally, the seventh chapter summarizes this work and concludes. It also provides a possible future scope to extend this work.