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Michele Nappi, Stefano Ricciardi, Massimo Tistarelli

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Deceiving Faces: When Plastic Surgery Challenges Face Recognition

Michele Nappi, Stefano Ricciardi, Massimo Tistarelli

Abstract—An exponential growth of the number of plastic surgery treatments specific to face (from the minimally-invasive ones to the real surgical procedures) has characterized the last two decades and it seems likely that this phenomenon, that has social and cultural meanings and implications, could spread even further in the next years as the average cost of these treatments is lowering and the wish for "beautification" is becoming part of the global aesthetics sense. For these reasons, face recognition as an established research topic has a new major challenge: delivering methods capable of high recognition accuracy even in case probe and gallery differ by a surgical alteration of face shape. To this aim is of fundamental importance understanding the range and the extent of the modification produced by the various types of treatments or by a combination of them. We present a survey of the state of the art on this topic, starting by an analysis of the diffusion of the facial plastic surgey and describing the key aspects of each of the most statistically relevant treatments available, resumed by a synthetic table. The paper includes a brief description of all the approaches proposed in the field so far to the best of authors' knowledge and a comparison of the performance reported by the existing methods when applied to the most referenced plastic surgery face dataset to date. A critical discussion of the results achieved so far and an insight about the challenges that still have to be addressed concludes this work.

Keywords: Face recognition, plastic surgery, state of the art survey

1 Introduction

In the scientific literature on face recognition, an introduction is often found reporting the positive features of this biometric trait (universality, acceptability and collectability, resistance to circumvention and recognition accuracy) as well as its peculiar weakness to environmental variations such as lighting, pose and occlusion, and a wide range of intra-class variations related to expressions, aging and other voluntary (piercing, tattoos, make-up, etc.) and involuntary (scars, moles, skin deseases, facial thraumas, etc.) modifications of the face appearance. However, it is worth noting that in the battle to improve methods robustness to the aforementioned challenges, there is an implicit assumption of an "overall consistence of face shape" between the enrolled template and the probe image. In other terms, the type and the level of intra-class variations should not alter too deeply the overall physiognomy. In this sense, while a wide range of expression or lighting variations represent a typical addressed issue, it is obvious (when considering age variations) that nobody would expect a high recognition accuracy by comparing a child to a boy or a boy to an adult or even an adult to an old man, as during these stages of life facial features are subject to dramatic changes often undermining overall face's shape consistence.

Though this example might seem too extreme, when it comes to facial plastic surgery, the aforementioned assumption can possibly become not true anymore even within the same age group, depending on the extent and on the type of the procedure per-

- *M. Nappi is with the BipLab, University of Salerno, Fisciano SA, 84084, Italy. E-mail: mnappi@unisa.it*
- *S. Ricciardi is with the BipLab, University of Salerno, Fisciano SA, 84084, Italy. E-mail: sricciardi@unisa.it*
- *M. Tistarelli is with the Computer Vision Laboratory, University of Sassari, Alghero SS, 07041, Italy, tista@uniss.it*