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StyleSage: Your Personalised Hairstyle Recommender Powered By ML

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Abstract: StyleSage is an innovative project that leverages advanced machine learning techniques to revolutionize hairstyle recommendations. By analysing user-provided face images, whether through image uploads or real-time camera input, the system accurately identifies the individual's facial shape from five categories: long, square, oval, heart, and round. This critical initial step sets the stage for tailored suggestions. Utilizing a diverse dataset of hairstyles, the model then selects the most fitting options based on the user's facial shape, resulting in a curated list of six hairstyle images. Beyond saving users time and experimentation, StyleSage enhances their confidence by offering personalized recommendations that harmonize with their unique features, seamlessly combining technology and beauty. Incorporating sophisticated image processing and machine learning algorithms, StyleSage bridges the gap between technology and personal aesthetics. Its ability to discern facial attributes enables precise facial shape classification, which, in turn, drives the selection of hairstyles that truly complement the individual. By fostering a synergy between data-driven predictions and the art of beauty, StyleSage empowers users to confidently explore hairstyles aligned with their distinct characteristics, marking a significant advancement beyond conventional recommender systems. Ultimately, StyleSage exemplifies the marriage of machine learning and personal expression, reinventing how we approach hairstyling choice

Keywords: Image Processing, Facial Attribute Analysis, Machine Learning Algorithms, Data-driven Predictions, Recommender Systems

I. INTRODUCTION

In the realm of personal aesthetics, the synergy between facial attributes and hairstyles plays a pivotal role in shaping individual appearance and self-confidence. The transformative impact of a well-chosen hairstyle can elevate one's beauty and self-assuredness to new heights. However, the challenge of selecting the most appropriate hairstyle persists as a nebulous endeavour, often marred by subjectivity and uncertainty. In response to this fundamental need, a breakthrough solution arises: StyleSage, a Hairstyle Recommendation System poised to revolutionize personal grooming. This innovative system provides tailored hairstyle suggestions based on the user's unique face shape, replacing traditional subjective methods with a cohesive and data driven approach. Recognizing the intricate relationship between face shapes and hairstyles, StyleSage harmonizes these elements to alleviate the uncertainty in hairstyle selection. Empowered by advanced machine learning techniques and a robust dataset of 25,434 examples representing diverse hairstyles, StyleSage categorizes face shapes into five groups—Oval, Round, Square, Long, and Heart. This classification forms the foundation for precise recommendations, aligning facial attributes with suitable hairstyles. In this work, we explore StyleSage's mechanics, methodologies, and outcomes. We delve into its data-driven insights and machine learning prowess, revealing how it offers individuals not just a hairstyle but a unique avenue to enhance their appearance and redefine their sense of self.

II. LITERATURE SURVEY

A novel framework for a face shape classifier-based hairstyle recommender system [1], aiming to assist individuals, especially women, in selecting suitable hairstyles based on their face shape. Identifying the correct face shape is considered a crucial initial step in hairstyling. The system enables hands-free hairstyle recommendations from a single face image, potentially impacting the beauty industry significantly. The paper emphasizes the importance of consulting with beauty experts when changing hairstyles, as there is no universally perfect hairstyle. It categorizes facial shapes into five groups: round, oval, oblong, square, and heart, each with a range of suitable hairstyles. The primary objective is to develop an effective face shape classifier, drawing inspiration from similar classification approaches but tailored to this specific purpose. The method relies on geometric features derived from landmark locations on the face, obtained using techniques like Active Appearance Models (AAM) and object detection. The research indicates that Support Vector

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Machine (SVM) with a Radial Basis Function (RBF) kernel yielded the most competitive results in classifying facial shapes according to expert criteria. The challenges of developing an effective hairstyle recommendation system grounded in facial attributes. A central issue highlighted is the scarcity of appropriate largescale datasets essential for training such a system. To overcome this hurdle, they introduce CelebHair, a substantial dataset originating from CelebA, featuring an impressive collection of over 200,000 facial images meticulously [2] paired with corresponding hairstyles and an array of facial attributes encompassing factors like face shape, nose length, and pupillary distance. While CelebA offers valuable attributes like gender, age, and attractiveness, it falls short in terms of facial landmarks and comprehensive hairstyle-related features, presenting certain limitations. Conversely, the Beauty e-Expert dataset, though rich in beauty-related attributes, is constrained by its limited volume, absence of male representation, and oversimplified hairstyle labels. On a different note, the Hairstyle30k dataset is primarily focused on hairstyles but lacks the inclusion of comprehensive facial attributes beyond hairstyle information, potentially rendering it inadequate for the holistic task of providing personalized hairstyle recommendations based on facial features. These dataset considerations underscore the critical role they play in advancing research within the domain of personalized hairstyle recommendations. In recent years, the rapid advancement of convolutional neural networks (CNN) and generative adversarial networks (GAN) has spurred the widespread application of artificial intelligence (AI) and deep learning in various domains, including beauty-related fields, as explored [3] in this study. Particularly, image recognition and separation have gained significance in automation and smart city development. Moreover, the COVID-19 pandemic has led to diversified ways in which individuals express their personalities, often through makeup, accessories, and hairstyling. Hairstyling, in particular, has become a pivotal avenue for individuals to convey their unique selves and is a prominent facet of contemporary self-expression.

III. PROPOSED WORK

The proposed system, StyleSage, is driven by the core objective of delivering personalized and precise hairstyle recommendations that align seamlessly with users' unique facial attributes. It sets out to achieve this by establishing a noninvasive methodology for hairstyle recommendations, ensuring a user-friendly experience that can be easily integrated into users' daily routines. Leveraging a diverse dataset of over 25,000 hairstyles tailored for various face shapes, StyleSage aims to enhance its pattern recognition capabilities, enabling it to accurately recommend hairstyles catering to a wide spectrum of preferences and individual characteristics. Moreover, the system is designed to be cost-effective and easily implementable into low-powered systems, requiring minimal modifications. In essence, StyleSage endeavours to redefine the hairstyling experience by offering tailored, accessible, and technologically seamless solutions to users seeking the perfect hairstyle.

IV. METHODOLOGY

The methodology for the proposed system encompasses data collection of diverse hairstyles and user images, employing Python with the Flask framework for backend development and utilizing LDA for facial attribute extraction. MLP models are trained to recognize facial shapes and correlate them with suitable hairstyles. Front-end development using HTML, CSS, and JavaScript creates an interactive user interface for image uploads and real-time input. The system generates personalized hairstyle recommendations based on facial attributes and prioritizes cost-efficiency and accessibility for low-powered systems. Rigorous testing and validation precede deployment, ensuring StyleSage provides a non-invasive, data-driven, and user-friendly solution, revolutionizing the hairstyling experience. The modules used in the proposed system are:

A. **Image Upload Module** The "Image upload" module in the proposed system serves as the initial user input step. Clicking the
"Try Now" button on the front page directs users to the image input page, offering two options: "Image Upload" and "Capture Photo." In the first option, users can upload an image by clicking the "Upload" button, which opens a file dialog for selection. The chosen image is then retrieved for processing. Alternatively, users can opt to "Capture Photo" by clicking the respective button, launching the device's camera interface for real-time image capture. This interface provides options to capture the photo or return to the image upload page. These streamlined choices facilitate user input for subsequent analysis.

B. **User Preferences Module** The "User Preferences" module enhances user engagement and satisfaction with the recommendation system by allowing them to personalize their hairstyle recommendations. Once the user's facial shape is predicted, this information is seamlessly carried forward. The predicted facial shape is displayed to the user for confirmation. Users can then customize their preferences by specifying their desired hair length and, if opting for longer hair, indicating their interest in updo hairstyles. These preferences significantly influence the types of hairstyles recommended. After inputting their choices and clicking the "Predict" button, the system processes the data, incorporating the user's preferences and predicted facial shape to generate tailored hairstyle recommendations. The results are rapidly displayed, presented in an intuitive and visually appealing manner, enabling users to visualize how the recommended

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hairstyles would appear on them. This module empowers users to actively participate in refining their personalized recommendations.

C. **Face Detection and Shape Prediction Module** The "Face Detection and Shape Prediction" module operates silently in the background, harmonizing inputs from various sources to enhance accuracy and relevance. It leverages the user's uploaded facial image, the previously predicted face shape, and personalized preferences from the "User Preferences" module to ensure a cohesive and tailored experience.

D. **Hairstyle Recommendation Module** The output from the "Face Detection and Shape Prediction" module, consisting of the accurately predicted facial shape harmonized with the user's personal preferences, seamlessly feeds into the "Hairstyle Recommendation" module. This output plays a pivotal role as a crucial input, guiding the system in tailoring hairstyle recommendations that perfectly align with the user's individual facial features, style preferences, and chosen hair length.

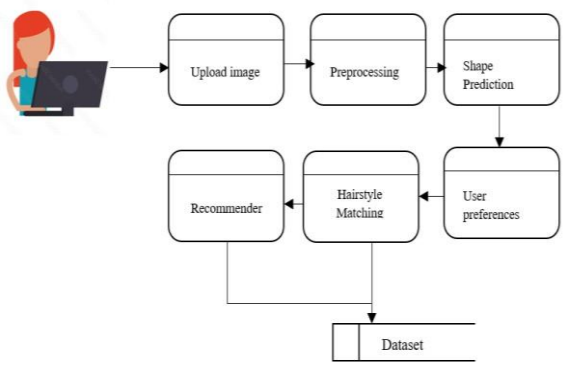

Fig 1 Overview of the Proposed System

This module is the heart of StyleSage, as it uses this comprehensive input to generate personalized and visually appealing hairstyle recommendations, ultimately enhancing the user's confidence and satisfaction with their hairstyle choices.

V. RESULT ANALYSIS

The below figure 3 shows the all the ML model that have been compared to different face shapes to find which model is used more accurate to perform our predictions. The figure below illustrates the visual representation of the table mentioned above.

Sl. No.	Shape	MLP	KNN	Random Forest	Gradient Boosting	LDA
0	heart	65	56	60	59	59
1	long	68	63	54	57	50
2	oval	72	51	59	66	71
3	round	74	79	76	76	69
4	square	62	49	61	68	67
5	Overall	68	58	61	65	64

Table 1 Comparison of models

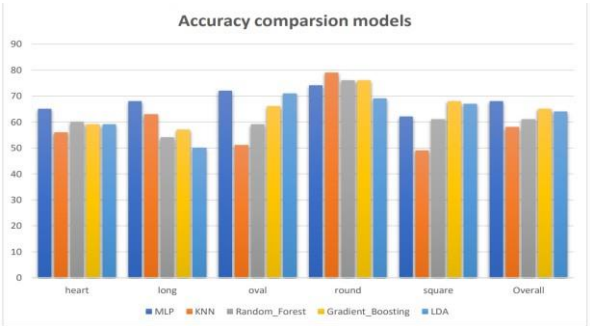

Fig 2 Comparison study of Accuracy of various models

The below figure shows the image upload via folder and camera for predicting user face shape and recommending the hairstyle. Below figure 6 shows predicted result giving best 6 hairstyle recommended images for user to choose from.

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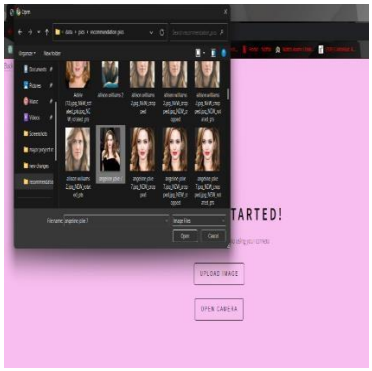

Fig. 3 image upload via camera

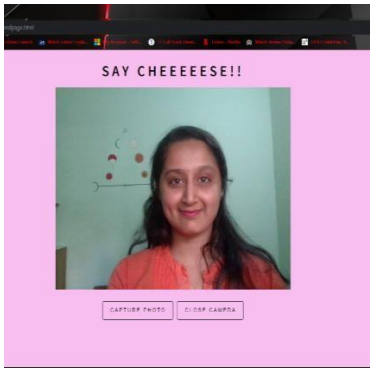

Fig 4 Camera upload

Fig 5 Camera upload

VI. CONCLUSION

In summary, StyleSage stands as an innovative and effective hairstyling recommendation system that harnesses the power of machine learning. Through a thorough evaluation process, we assessed multiple models including MLP, KNN, Random Forest, Gradient Boosting, and Linear Discriminant Analysis. Among these, the MLP model emerged as the leader, achieving an impressive accuracy rate of 68.35% on the test dataset. This underscores its ability to capture intricate patterns between facial features and hairstyle recommendations, making it a valuable contender for integration into StyleSage. Our meticulous analysis extended to precision and recall values across distinct hairstyle categories, offering valuable insights into model performance for each. Leveraging macro and weighted averages allowed us to comprehensively gauge model effectiveness across categories. This comprehensive evaluation culminated in the selection of the MLP model as the frontrunner for the StyleSage system, paving the way for a personalized and reliable hairstyling recommendation experience that redefines how users explore and select hairstyles.

VII. ACKNOWLEDGEMENT

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REFERENCES

[1]. A hybrid approach to building face shape classifier for hairstyle recommender system, Kitsuchart Pasupa, Wisuwat Sunhem, Chu Kiong Loo
[2]. CelebHair: A New Large-Scale Dataset for Hairstyle Recommendation based on CelebA, Yutao Chen, Yuxuan Zhang, Zhongrui Huang, Zhenyao Luo
[3]. Development of Hairstyle Conversion System Based on Mask R-CNN, Seong-geun Jang, Qiaoyue Man and Young-Im Cho