Palm Images Designing and Reviewing Using SVM Model for Gender Detection

[1]Jahnvi Rajyaguru, [2]Dr. Falguni Parsana
[1,2]Assistant Professor, Department of Computer Science,
Atmiya University, Rajkot
[1]jhanvi.rajyaguru@atmiyauni.ac.in, [2]falguni.parsana@ atmiyauni.ac.in
http://doi.org/10.64643/JATIRV1I1-140032-001

Abstract - This work is based on identifying a person's gender using their palm image. In this paper the applied machine learning algorithm is called Support Vector Machine (SVM) to train a model that can recognize whether the palm is of a male or female. More than 11,000 palm images are collected and processed them by resizing, flipping, and making necessary adjustments to improve the model's learning. The model was trained using the key features from these images and then tested to see how accurately it could make predictions. The results showed high accuracy, proving that palm-based gender detection using SVM is both efficient and smart. I also compared this technique with traditional palm reading methods to highlight how modern technology can make palm analysis more reliable, especially for practical use in fields like security, health screening, and advanced smart systems.

Index Terms - AI-based Gender Detection, Biometric Authentication, Data Augmentation, Feature Extraction, Gender Prediction, Image Classification, Image Pre- processing, Machine Learning, Modern Palmistry, Palm Images, Real-world Application, Smart Identification Systems, Supervised Learning, Support Vector Machine (SVM)

I.INTRODUCTION

In today's time, identifying gender using biometric methods has become a very interesting research topic. Among all the biometric options, palm images are quite useful because they contain important details like shape, texture, and palm lines [1]. In this research work, the Support Vector Machine (SVM) algorithm is used to classify gender using palm images.

SVM is a supervised machine learning algorithm that works very well for classification problems. It separates two classes by drawing the best possible boundary (also called a hyperplane) between them. In this paper, SVM is used to tell the difference between male and female palm images by first collecting the data and then extracting features from those images [2].

The work started by preparing the dataset, where some pre-processing tasks like resizing the images, normalizing them, and using data augmentation to improve the quality is done and extracted important features from the images which were given as input to the SVM model.
During the training process, to tried different kernel functions and tuned the model to get better results. The measured the performance of novel model using metrics like accuracy, precision, recall, and F1-score.
At the end, the model gave very good results and high accuracy in classifying gender from palm images. This shows that using SVM for gender detection can be a strong and effective method, especially in biometric systems and real-time applications.

II. RELATED WORK

Many researchers have already worked on gender classification using different biometric features like face, voice, iris, walking style (gait), and palm [3]. Out of all these, palm images are very useful because they have many important features like lines, shape, and texture, and they are not affected much by lighting or facial expressions.
In the past, some researchers used deep learning models like CNN, while others used machine learning methods such as Decision Tree, KNN, and SVM. Among these, SVM is a very popular and powerful algorithm [4]. It gives good results even when we don't have a very large dataset.
Some studies have used features from the palm's shape and applied SVM for classification and got good accuracy. Other researchers have used special filters like Gabor filters to take out the texture features from palm images and then used SVM to classify gender [5]. In many of those works, SVM gave better results than other algorithms in terms of both speed and accuracy.
After studying all these past works, decided to apply SVM to my own palm image dataset [6]. This work is focused on choosing the right features and improving the model step-by-step to get better accuracy.

Importance of Gender Classification

Gender classification may look like a small task, but it is very useful in many areas. It helps in making systems smarter and more accurate. Here's how:
1) Improves Security Systems: When we add gender along with other biometric features like palm or fingerprint, the system becomes stronger and more accurate. It helps in confirming the identity better [7].
2) Gives Personalised Services: Many apps or websites show better suggestions if they know the user's gender - like shopping apps, fitness apps, or online ads.
3) Helpful in Healthcare: Some health problems are different for males and females. So, if gender is known, apps or systems can give more suitable health tips and warnings.
4) Used in Police and Investigation Work: In missing cases or crime investigations, gender from palm or other [8] parts helps narrow down the search and save time.
5) Smart Technology Interaction: Devices like voice assistants or machines that talk to users can

give better answers if they know the user's gender and act accordingly [9].
6) Useful for Research and Surveys: In any kind of data collection, knowing how many male or female users are there helps understand the data better [10].

III. ROLE OF SVM IN CLASSIFICATION

In this project, Support Vector Machine (SVM) is used to classify gender based on palm images. It played a very important role in the success of my model. SVM is very useful when we have to divide data into two groups - like male and female. [11]. It works by finding the best line (or hyperplane) that separates the two classes clearly. This line keeps both classes as far apart as possible, which helps the model give more correct results.
The best part about SVM is that it works very well even if we don't have a very large dataset. It only focuses on a few important data points, which are called support vectors [12]. These support vectors help the model learn the difference between classes in a simple and smart way. If the data is not easy to separate in a straight line, SVM uses something called a kernel (like RBF or polynomial) [13], which helps in converting the data into a new form where it becomes easy to separate the classes.
In novel gender classification model, SVM gave very good accuracy and helped in correctly separating male and female palm images. That's why it played a big role in my research.

Why Palm Images Are Chosen?

In this project palm images are chosen because they have many useful features like palm lines, shape, and skin texture that are different for every person. The best thing is that palms don't change much with expressions, age, or light [14], unlike face or voice. Also, palm images are easy to take using a normal camera. Because of all these reasons, palm images are a good option for gender classification and give better, stable results.

Comparison between Traditional and Modern Palmistry Approaches

Topic	Traditional Palmistry	Modern / Advanced Palmistry
Way of Study	Based on beliefs, spiritual thoughts, and personal experience	Based on science, data, and technology
What it Looks At	Palm lines, shapes, fingers, and mounts	Features from palm images using computer and algorithms
Tools Used	Human eyes, handbooks, or sometimes magnifying glass	Camera, scanner, computer software, machine learning tools
Main Purpose[15]	To predict future, personality, luck, marriage, etc	To detect gender, verify identity, or find health-related info
Accuracy	Depends on the palm reader's understanding and skills	Gives results based on real data and accuracy checking
Proof or Evidence	Mostly belief-based, no scientific proof	Based on research, testing, and actual results
Where It's	Astrology centres, by pandits or	In research labs, security systems, forensic,

Used	palm readers	and medical fields
How It's Learned	Learned from elders or by practice	Learned through education, training, and coding
How It's Read	Every reader may give different meanings	Computer gives the same result based on trained model
Examples	Telling about future, job, love life	Classifying gender from palm, checking health risks, person verification

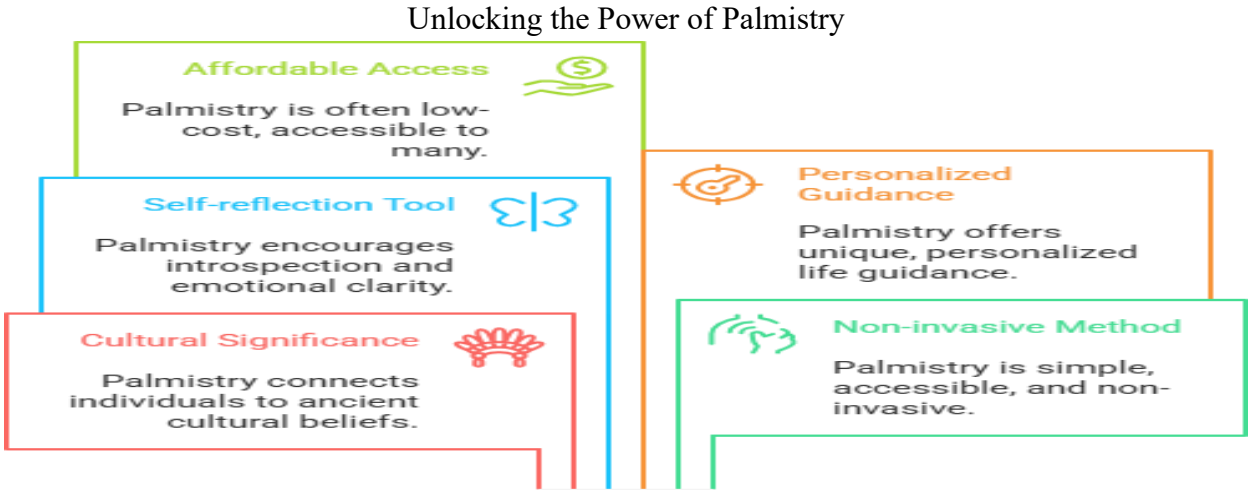

Fig: 1 Benefits of Traditional Palmistry

Fig: 2 Benefits of Modern Palmistry

Traditional palmistry comes with many benefits that make it popular among people even today. First, it is affordable and easy to access, as it doesn't require any costly tools—just your palm and a reader. It also works as a great tool for self-awareness.

When someone reads your palm, it often makes you think about your personality, life path, and choices, helping you gain emotional understanding.

Modern Palmistry Benefits: Accuracy Meets Tradition

Modern palmistry mixes traditional palm reading with new technology to give more accurate results. With digital help, the process becomes simpler and can be done from anywhere. It also helps save palm data for future use. This method keeps the old practice alive but makes it more useful in today's World.

Today's palmistry uses both old hand-reading techniques and modern tech to make the process better and easier to understand. People can now have their palms read online from wherever they are. It also helps keep their palm records safe and ready for future use or comparison.

IV. DATASET DESCRIPTION AND PRE-PROCESSING

For this research work, total of 11,076 palm images, are used where each image had a label - male or female - embedded in the file name. The photos were taken in a proper setup, making sure the hand's position and angle were the same throughout to keep the quality consistent. Before training the model, the images are prepared by resizing them to one size, adjusting color if needed, and normalizing the pixel values so the model could learn more effectively [17]. Also used data augmentation like flipping and rotating the images to add variety and avoid overfitting.

These steps helped me prepare a clean, balanced, and ready-to-use dataset for gender classification. In this research, we worked with a dataset of 11,076 palm images, where each image was labelled as male or female through the file name itself. The images were taken in a proper setup, keeping the hand position and angle the same to maintain quality.

Before using them in the model, I applied some pre- processing steps. I resized all images to the same size, changed the color format if needed, and normalized the pixel values to help the model learn better [18]. Also used data augmentation like flipping and rotating the images to add variety and avoid overfitting. These steps helped me prepare a clean, balanced, and ready-to-use dataset for gender classification.

V. PRESENTED MODEL

In this research, a model developed to detect gender using palm images by applying the Support Vector Machine (SVM) algorithm. SVM is a powerful machine learning technique known for its ability to classify data into two distinct groups - in this case, male and female. To begin, the dataset of palm images are prepared by resizing them to a standard size, normalizing the pixel values, and

using data augmentation techniques. These steps helped improve the quality, consistency, and variety of the data, which in turn supported better model training.

After that, extracted important features from the images and used them to train the SVM model. SVM is selected because it performs well with complex data and delivers accurate results. Once the training and testing were completed, the model showed strong performance, proving that SVM is a reliable method for gender classification based on palm images.

VI. MODEL TRAINING AND EVALUATION

Once preparing the palm images are finished, the pulling out the important details, and used the Support Vector Machine (SVM) algorithm to train novel model. The data are split into two parts - one for training and one for testing to see how well the model could actually perform. During training, it learned to spot the unique patterns that separate male and female palm features.

After that, tested the model using new images it hadn't seen before. This helped to check if it could make accurate predictions in real life situations. To understand how well it worked, we used evaluation methods like accuracy (for overall correct results), precision and recall (for class-wise performance), and the F1-score (for a balanced view).

In the end, the model gave good results, showing that SVM is a smart and reliable choice for gender detection from palm images.

✅ Accuracy: 0.7766143106457243

📄 Classification Report:

	precision	recall	f1-score	support
female	0.76	0.78	0.77	1091
male	0.79	0.78	0.78	1201
accuracy			0.78	2292
macro avg	0.78	0.78	0.78	2292
weighted avg	0.78	0.78	0.78	2292

Fig: 3 Result of SVM (Support Vector Machine)

This graph shows how many palm images used in dataset for classifying gender. There are about 6,000 images of male palms and around 5,500 of female palms, which means the data is almost

equally divided. The small gap between the two doesn't really affect how the model performs. Keeping the numbers nearly equal is important because it helps the SVM model learn the patterns of both genders properly. If one side had way more images, the model might start favoring that one. But here, both classes are close, so the learning stays balanced.

Having this kind of dataset gave my model a good base to learn from. It helped the model give more fair and accurate results. Since I'm working on gender prediction through palm images, this balance made the whole process stronger and more reliable in real-world use.

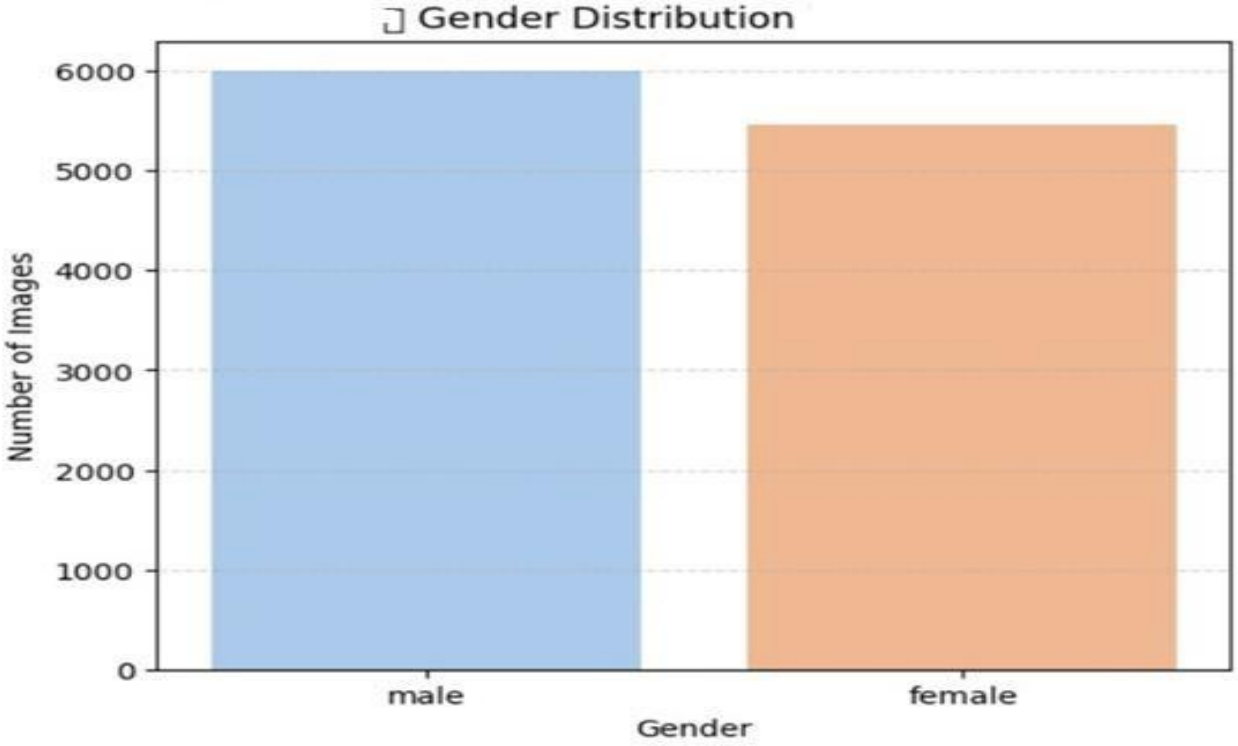

Fig: 4 Gender Detection

VII. CONCLUSION

In this paper, I have worked on gender prediction using palm images with the help of the SVM algorithm. After building and testing the model, it is clear that palm images can be a useful source for identifying gender. The dataset used was almost balanced, with slightly more male images, which helped in training the model properly for both classes.

The SVM algorithm gave good results and showed that it can handle classification tasks very well. It's easy to use and gives accurate outcomes when the data is clean and well-organized. That's why SVM was a suitable choice for my project.

Overall, this work shows that gender detection using palm images is possible and effective. It also proves how important the quality and balance of the dataset is. In the future, this model can be improved by testing with other algorithms or adding more images to make it more general and accurate.

REFERENCES

[1] Cortes C, and Vapnik V (1995) Support-vector network. Mach Learn 20(3):273–297.

[2] Zhou, J.; Zhao, Y. Application of convolution neural network in image classification and object detection. Comput. Eng. Appl. 2017, 53, 34–41.

[3] P. Rai and P. Khanna, "Gender Classification using Randon and Wavelet Transform", IEEE International Conference on Industrial and Information Systems, pp. 448 - 451, August. 2010.

[4] G. Cottrell and J. MetcaJfe,"Empath: Face, emotions and gender recognition using Holons," Neural information processing systems, pp. 564-571.vol. 3, 1990.

[5] T. Jabid and H. Kabir, "Gender classification using Local Directional Pattern (LDP)", IEEE International Conference on Pattern Recognition, pp. 2162 - 2165, August. 2010

[6] S. Ravi and W. Wilson," Face detection with facial features and gender classification based on SVM," IEEE international conference on computational intelligence and computing research, pp. 23 -28, December. 2010

[7] Z. Sun, X. Yuan and J. Louis, "Neural Network Based gender classification Using genetic search for Eigen feature selection," IEEE international joint conference on Neural networks, pp. 2433 - 2438, August 2002.

[8] X. Han, H. Ugail and I. Pahnar, "Gender classification based on 3D face geometry features using SVM", IEEE international conference on cyber world, page. 114 -118, September 2009.

[9] W. sheng Chu, C. Rong and C. Song Chen, "Identifying gender from unaligned facial hnages by set classification", IEEE 20th international conference on pattern recognition, pp. 2636 - 2739, August 2010

[10] Matthias, D. Juergen, G.; Gabriele, F.; Luc, V.G. Real-time facial feature detection using conditional regression forests. In Proceedings of the 2012 IEEE Conference on Computer Vision and Pattern Recognition, Washington, DC, USA, 16–21 June 2012; pp. 2578–2585.

[11] Syed, Z.G. Ajmal, M. Perceptual differences between men and women: A 3D facial morphometric perspective. In Proceedings of the IEEE 22nd International Conference on Pattern Recognition, Stockholm, Sweden, 24–28 August 2014.

[12] Ping-Han, L. Jui-Yu, H.; Yi-Ping, H. Automatic gender recognition using fusion of facial strips. In Proceedings of the 20th International Conference on Pattern Recognition, Istanbul, Turkey, 23–26 August 2010; pp. 1140–1143.

[13] Juan, B.C.; Jose, M.B.; Luis, B. Robust gender recognition by exploiting facial attributes dependencies. Pattern Recognit. Lett. 2014, 36, 228–234.

[14] Modesto, C.S.; Javier, L.N.; Enrique, R.B. On using periocular biometric for gender classification in the wild. Pattern Recognit. Lett. 2016, 82, 181–189.

[15] Sinha, P.; Balas, B.; Ostrovsky, Y.; Russell, R. Face recognition by humans: Nineteen results all computer vision researchers should know about. Proc. IEEE 2006, 94, 1948–1962.

[16] Khan, K.; Mauro, M.; Migliorati, P.; Leonardi, R. Head pose estimation through multi-class face segmentation. In Proceedings of the 2017 IEEE International Conference on Multimedia and Expo (ICME), Hong Kong, China, 10–14 July 2017; pp. 175– 180.

[17] Ng, C.B.; Tay, Y.H.; Goi, B.M. A review of facial gender recognition. Pattern Anal. Appl. 2015, 18, 739–755.

[18] Yu, S.; Tan, T.; Huang, K.; Jia, K.; Wu, X. A study on gait-based gender classification. IEEE Trans. Image Process. 2009, 18, 1905–1910.

[19] Baluja, S.; Rowley, H.A. Boosting sex identification performance. Int. J. Comput. Vis. 2006.

[20] Burton, A.M.; Bruce, V.; Dench, N. What's the difference between men and women? Evidence from facial measurement. Perception 1993, 22, 153–176.

[21] Toews, M.; Arbel, T. Detection, localization, and sex classification of faces from arbitrary viewpoints and under occlusion. IEEE Trans. Pattern Anal. Mach. Intell. 2009, 31, 1567–1581.

[22] Khan, F.S.; Van De Weijer, J.; Anwer, R.M.; Felsberg, M.; Gatta, C. Semantic pyramids for gender and action recognition. IEEE Trans. Image Process. 2014, 23, 3633–3645.

[23] Han, H.; Otto, C.; Liu, X.; Jain, A.K. Demographic estimation from face images: human vs. machine performance. IEEE Trans. Pattern Anal. Mach. Intell. 2015, 37, 1148–1161.