

A Technical Approach for Promotion of Yakshagana - A Literature Survey

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ABSTRACT

Background/Purpose: *Yakshagana is a theatre style that combines varieties of make-up styles and dressing styles depending on the type of character or role that is to be played on the stage. This article briefly discusses certain areas of Yakshagana where technology can be used for object detection and make-up recognition to classify and identify the characters.*

Objective: *The main objective of this literature survey is to summarize the techniques used to identify different objects in a Yakshagana image & to identify the different makeup styles to recognize the type of characters. This paper also recommends the technical methods that can be used to promote Yakshagana.*

Methodology: *Information is collected from various scholarly articles, books, and web pages.*

Findings/Results: *Based on the analysis of the papers reviewed, it is observed that, no much work is carried out in the field of object detection & make-up detection in Yakshagana. This survey paper recommends techniques and the methodology that can be applied to the Yakshagana field to identify and classify the objects and detect the patterns in makeup in Yakshagana roles.*

Limitations: *The study is limited to crown & jewelry detection and pattern recognition in facial makeup in Yakshagana*

Originality: *This paper focuses on the summary of techniques used to identify the objects, facial recognition, and pattern in make-up detection.*

Paper Type: *A Literature survey paper on techniques and methods used to meet the required objectives.*

Keywords: Yakshagana, Folk Media, Folk Theatre, Ornament detection, Jewel detection, Object detection, Make-up detection, Face recognition, Pattern Matching, SWOC Analysis.

1. INTRODUCTION :

Yakshagana is an open theatre drama also called *Bayalaata* in the Kannada language where *bayalu* means an open place and *Aata* means play. This style of drama is mostly prevalent in Karnataka's coastal districts in numerous variations. The version of Yakshagana is known as *Thenku-thittu* in Dakshina Kannada district of Karnataka state and Kasaragod district of Kerala state. It is known as *Badaga Thittu* in Udupi and Uttara Kannada districts. But both of these versions are equally popular in both regions [1].

Yakshagana performance includes background music performed by musicians called *Himmela* and a dance and dialogue troupe called the *Mummela*. Both *mummela* and *himmela* artists work together on the stage to depict lyrical epics. Little research was done on *himmela* but till now minimal research was conducted on *Mummela* [1]. The *Mummela* artist who is going to perform on the stage has to come up with makeup and proper costume. This survey paper concentrates on recommending different jewelry and ornament detection techniques and makeup style methods that can be used to popularize Yakshagana in the future and to make the beginners learn Yakshagana makeup and dressing styles easily.

There are different parameters required to identify a character that is played on the Yakshagana stage. The parameters may include object detection techniques to identify crowns, jewels & swords, pattern recognition modeling to identify the patterns on the facial makeup, and dressing styles. There are different object detection techniques, using which, one can detect objects in an image or a video. In this survey, we have highlighted some of these techniques which can be used for the said purpose.

The topics covered in the paper are as follows: (i) Objectives and methodology of the literature survey, (ii) Summary of related work, (iii) Present status of Yakshagana Industry, (iv) Research gaps and Proposal, (v) Research agenda, (vi) Limitations of Research proposal, (vii) SWOC analysis of research proposal, and (viii) Conclusion.

2. OBJECTIVES :

The objectives are the essential components that play a very important role in providing a detailed view of the goal of any research. The following are the objectives of this literature survey :

- (1) To determine how the Yakshagana industry has grown and to come up with the research findings that have been already carried out in this industry.
- (2) To study the methodology adopted to popularize Yakshagana in the media.
- (3) To know the present status of the Yakshagana industry in encouraging people to learn Yakshagana.
- (4) To determine the research gaps and to propose the ideal solution to those research gaps.
- (5) To list out the research agendas and limitations of the research.

3. METHODOLOGY :

The data and the information are retrieved from secondary sources such as books, articles, websites, magazines, and journals. Initially, the data related to Yakshagana are collected from books and articles, then a review process is carried out and identified some of the issues in papers reviewed.

4. LITERATURE REVIEW :

Karant, K. S. (1958) in his paper discussed the history of Yakshagana. In this survey, the author highlighted views on Yakshagana manuscripts, costumes, Literacy, himmela, mummela, and troupes. The author also mentioned about roles of Hindu temples in the Yakshagana field [2]. Ashton M. B.(1969) mentioned that Yakshagana is the most colorful and very famous folk-theatre form found in the coastal region of Karnataka. The themes for Yakshagana are taken from the *Puranas* of Hindu mythology such as *Ramayana*, *Mahabharatha*, *Bhagavatha*, *Devi Purana*, etc [3]. Upadhyaya, K. S. (1969) discussed the features of Yakshagana. According to the author, there are no predefined dialogues that an artist has to deliver on the stage. The artist has to dance and then improvise and deliver the stanza presented by *Bhaagavatha*. The author also highlighted points on costumes and makeup and also discussed every character's unique style of makeup and dressing [4]. Ashton, M. B. (1976) explained in detail about Literature and presentation of Yakshagana, Performance background, staging, dance, and music. The author also explained the different stages that a Yakshagana passes through and how artists use their knowledge in depicting a story in the form of play by considering the example of two different troupes where the same scene is considered from the same *Prasanga*. [5]. In the view of Bapat, G. V. (1998), Yakshagana is presented in two forms: First, with makeup, dressing, or dance, which is called as *Bayalaata*, and second without makeup, dressing or dance which is called as *taalamaddale*. The entertainment media such as television, cinema, etc have had had little impact on Yakshagana's popularity because it satisfies people's emotional needs [6]. Kumar, S. (2010) mentioned that Yakshagana is playing a role in social communication development. The author suggests that the artists and the learners should be given proper training in developing and popularizing Yakshagana and highlighted that *Taalamaddale* was used a little less in development messages whereas *Bayalaata* was successful in communication development [7]. Binder, K. (2012) discussed textual and performative re-use in Yakshagana. Yakshagana is not only presenting stories of *Puranas* but in recent years it is reusing the stories from popular films or epics of local oral which ensures the popularity of this art. The author concluded by saying Yakshagana helps in bringing down the anxiety of the audience because of the adoption of the reusability concept [8]. Kumar, S. (2010) is of the view that changes must take place in Yakshagana along with the time and situation without harming the past beliefs. One must adopt new techniques and technologies to attract people towards Yakshagana [9]. Adding points to this, Padmanabha, K. V., & Kumar, S. (2019) discussed the diversity in themes of Yakshagana. Non-

mythological modern themes are explored and presented to showcase the role of Yakshagana in different areas like imaginary, historical, drama, etc [10]. According to Padmanabha, K. V et al. (2020), Yakshagana is not only performed to entertain people but is also successful in creating awareness about health issues and solutions. In recent years Yakshagana performance was organized to educate people on different diseases like HIV/AIDS, COVID-19 [11].

From the above survey, it is clear that Yakshagana is not only entertaining people with its unique style of dance, costumes, makeups, singing, etc, but also it is playing a vital role in educating the illiterate and people who are eager to learn the art of Yakshagana in a shorter period. It is observed that the research is carried out in its history and its diversity in reaching people in the present era. Minor exploration has been carried out by considering make-up and dressing styles. Since each character has its style of dressing and make-up, classifying and identifying the character also plays a crucial role in understanding the theme. Bridging this research gap can be facilitated by considering the technological approach to Yakshagana. This process involves in classification and identification of various types of crowns, swords, jewels in dressing-up, and patterns used in facial make-up. Several machine-learning and image processing algorithms can be implemented to perform the comparative analysis of their efficiencies. The following table summarizes the research findings on object detection, Face recognition, and facial make-up.

Table 1: Related papers on Object detection, Face recognition, and Make-up detection.

S. No	Author(S)	Year	Method Used	Findings/Results
1	Chandan, G. et al. [12]	2018	SSD (Single Shot Detector)	The authors are with the view that, in real-time scenarios, SSD can be used to detect objects trained with better accuracy. The same model can be deployed in surveillance devices.
2	Galvez, R. L. et al. [13]	2018	SSD and Faster RCNN	SSD and Faster RCNN are compared and found that SSD can be used with MobileNetV1 to achieve fast detection and low accuracy. Use Faster-RCNN with InceptionV2 to achieve high accuracy but with low speed.
3	Ren, Y. et al. [14]	2018	Fast/Faster RCNN	This paper demonstrates the process of employing convolutional architectures in Fast or Faster RCNN. The experiment was conducted on the VOC2007 dataset and found that, for object detection, a classifier with a convolutional layer is more successful.
4	Pham, M. et al. [15]	2018	Faster RCNN	This paper deals with the use of Faster RCNN in detecting underground buried objects in GPR images. It is found that the proposed technique improves the detection results compared to computer vision methods.

5	Li, Z. et al. [16]	2018	DetNet	The authors compared one-stage and two-stage object detection methods and noticed the differences between object detection and image classification. To overcome the limitations, the authors proposed the DetNet method which has a backbone network for object detection. This method is used for both localization and classification.
6	Wong, A. et al. [17]	2018	Tiny-SSD	The authors are of the view that the proposed method is used for real-time embedded object detection. This model is smaller than Tiny-YOLO in size but achieved 4.2% greater mAP compared to Tiny-YOLO on the VOC207 dataset.
7	Sharma, V. et al. [18]	2019	Saliency driven Faster RCNN model	ASCAL VOC 2007, PASCAL VOC 2012 & CAMO_UOW dataset is used for the experiment. Good detection results were observed compared to conventional models.
8	Xu, H. et al. [19]	2019	Reasoning-RCNN	The proposed method was successful in achieving a 16 percent upswing on VisualGenome, 37% on ADE, and 15 percent upswing on COCO.
9	Benjdira, B. et al. [20]	2019	Faster RCNN and YOLOV3	Here the authors compared Faster RCNN and YOLOV3 methods on aerial images for object detection and it is observed that YOLOV3 performs better compared to Faster RCNN in terms of processing time and sensitivity.
10	Mao, Q. C. et al. [21]	2019	Mini-YOLOv3	The authors proposed Mini-YOLOv3 from YOLOv3 and they found that their method achieved better accuracy compared with YOLOv3 in 0.5 detect times on the MS-COCO dataset.
11	Choi, J. et al. [22]	2019	Gaussian yolov3	Compared to YOLOv3, it is found that the proposed algorithm progresses mAP

				by 3.1 and 3.5 on BDD and KITTI data sets. It is suggested that this method can be used to achieve higher accuracy for autonomous driving applications.
12	Yi, Z. et al. [23]	2019	Tiny- YOLOv3 using K-means clustering	The authors proposed a pedestrian detection network model which resulted in higher detection accuracy for VOC2007 pictures but it was not well successful in detecting smaller objects with higher accuracy.
13	Ou, X. et al. [24]	2019	Moving Object Detection Method via Resnet-18 using encoding and decoding	Gives better performance compared to conventional algorithms but faces some challenges with smaller object detection
14	Haque, M. F. et al. [25]	2019	Resnet Network with VGG	For accurate object detection and image classification, the authors proposed a very deep convolutional VGG network. Though it has issues with localization and training, this proposal achieved high accuracy in large-scale image classification. To minimize the training error and to detect a small object, the Resnet network is implemented in VGG.
15	Lu, Z. et al. [26]	2019	YOLO and Resnet	This paper proposed a hybrid network with Resnet and YOLO combinations for detecting multiple objects. Here the natural scene images are considered for experiment and it has resulted in 75.36% accuracy in detecting multiple objects.
16	Lu, X. et al. [27]	2019	Resnet-based SSD	Resnet-based SSD model is proposed to increase the accuracy by 17.4% compared to VGG but with a high amount of calculation.
17	Bai, Z. et al. [28]	2019	Combination of Residual convolutional neural network, YOLOv3-Tiny algorithm	The proposed model is tested on the PASCAL VOC dataset. To improve the result of object detection, a prediction layer is added to the neural network. This model achieved 64.46%

				accuracy in real-time target detection.
18	Janahiraman, T. V. et al. [29]	2019	SSD MobileNet V2 and Faster-RCNN	In this paper, SSD MobileNet V2 and Faster-RCNN methods are compared to detect traffic lights. The experiment is carried out with 44 images using the TensorFlow framework and the result shows that Faster RCNN is better compared to SSD With an accuracy of 97.01%.
19	Fang, W. et al. [30]	2019	Tinier-YOLO	The authors proposed a Tinier YOLO which is four times smaller than Tiny-YOLOv3 to achieve improved detection accuracy.
20	Yundong, L. I. et al. [31]	2020	Multiblock SSD	Multiblock SSD is proposed to overcome the limitations of detecting smaller objects. The experiment is done on samples of railway scene and the result showed that the proposed model achieved an accuracy of 96.6% which is greater than 9.2% when compared with traditional SSD.
21	Younis, A. et al. [32]	2020	Mobilenet SSD	The authors combined MobileNet and SSD for real-time object detection in a fast and efficient manner. This method is trained and tested on a minimal number of images but achieved good detection accuracy and increased processing speed.
22	Mahmoud, A. et al. [33]	2020	Mask-RCNN	FRCN, YOLO1, YOLO2, SSD, RFCN are compared with Mask-RCNN with NWPS dataset and found that the proposed method detected objects with 6% greater average precision (AP) than the other mentioned object detection methods.
23	He, Z. et al. [34]	2020	Asymmetric tri-way Faster-RCNN	To avoid the possibility of the source domain collapsing, this method was proposed.

24	Zhao, L. et al. [35]	2020	Improved YOLOv3	Here K-means is used to predict the height and width of bounding boxes and to count the distance between bounding boxes, it uses a Markov chain. The proposed method achieved better performance in terms of F1-score and mAP compared to YOLOv3.
25	Zhao, H. et al. [36]	2020	Mixed YOLOv3-Lite	To overcome the limitations like excessive power consumption and limited computing power on mobile smart devices, this model is proposed. This model is smaller in size compared to YOLOv3, tiny-YOLOv3, and slimYOLOv3 and achieved better accuracy with higher efficiency.
26	Zhang, S. et al. [37]	2020	Tiny-YOLO	The authors proposed a model to detect object passengers in the bus. This paper concentrated on reducing the calculation burden and increasing the operation speed. The result shows that the proposed model is four times faster in detecting passenger objects compared with traditional object detection methods.
27	Long, X. et al. [38]	2020	PP-YOLO based on YOLOv3	The authors conducted experiments on PaddlePaddle to check the balance between accuracy and effectiveness of object detectors. Based on YOLOv3, the author developed PP-YOLO for this purpose and achieved a balanced rate of 45.2 mAP with 72.9 FPS efficiency.
28	Bochkovskiy, A. et al. [39]	2020	YOLOv4	The authors proposed YOLOv4 to improve the AP and FPS of YOLOv3. The proposed model achieved an improved AP of 10% and FPS by 12% in detecting objects.
29	Jiang, Z. et al. [40]	2020	YOLOv4-tiny based on YOLOv4.	The authors proposed a real-time fast object detector that uses the Resnet-D network.

				The proposed model is suitable for mobile and embedded devices.
30	Sun, C. et al. [41]	2021	Mask guided SSD	The proposed model is evaluated using Tsinghua-Tencent 100K and Caltech pedestrian datasets and the results have shown that the model is successful in detecting small objects with comparable performance with other methods.
31	Wang, C. Y. [42]	2021	Scaled-YOLOv4	The CSP-based YOLOv4 object identification neural network scales up and down, making it suitable for both small and large networks while maintaining optimal speed and accuracy.
32	Kose, N. et al. [43]	2015	SVM and Alligator for makeup detection	This paper proposed a facial make-up detector to reduce the effect of make-up in face recognition. Alligator and SVM classifiers are used for feature extraction on images of FCD, YMU, & MIW databases and it is observed that significant accuracy is achieved in face recognition with make-up.
33	Ranjan, R. et al. [44]	2017	Hyperface based on Deep CNN, Resnet for makeup detection	The authors presented an algorithm to detect the face, recognize the gender and pose estimation. The proposed model was successful in capturing local and global data in the face. The experiment is tested with AFW, PASCAL, and FDDB datasets and the result is effective.
34	Sun, X. et al. [45]	2018	Face detection using Deep learning	An improved version of RCNN was used to achieve state-of-the-art performance by conducting experiments on n FDDB testbed.
35	Zhang, C. et al. [46]	2018	FDNet1.0 – Faster RCNN for detecting the face	WIDER FACE data is considered and found that the proposed method is more effective than RCNN.
36	Masi, I. et al. [47]	2018	Deep Convolutional Neural Network.	This paper summarizes the last five years' papers on face recognition techniques. Here are the issues related to

				video-based face recognition and clustering.
37	Bertacchi, M. G. et al. [48]	2019	CMYK color model and Neural Networks	The authors compared CMYK and HSV color models to detect facial makeup and the highest accuracy is achieved on the face and eye region with the CMYK model.
38	Rathgeb, C. et al. [49]	2019	Deep Neural Networks - conceptual categorization of beautification	The authors surveyed papers presented in recent years and issues and challenges with face recognition are discussed.
39	Ranjan, R. et al. [50]	2019	Deep Pyramid Single Shot Face Detector based on DCNN	The model proposed by the authors is capable of detecting tiny faces. The proposed system is tested with IJB A, B, C, and IARPA datasets and achieved near state-of-the-art results.
40	Joshi, A. S. et al. [51]	2020	Deep learning	The authors designed a model which suits speech tasks. This model detects and tracks speakers from raw videos. This model concentrates on the method to detect face masks from video.
41	Sati, V. et al. [52]	2020	DNN using OpenCV and Resnet-34 architecture	The author is of the view that compared to Haar Cascades, the Deep Learning Face Detector of OpenCV gives better accuracy (99.96%) in detecting the face. With the inclusion of facial embeddings in real-time, it is possible to achieve an accuracy of 79.85% in recognizing the face. In other scenarios or different backgrounds, 86.41% accuracy can be achieved. An accuracy of 75% is achieved while identifying facial emotions.
42	Fang, Z., et al. [53]	2020	Resnet based face detector	To address the issues related to accuracy and computational cost in identifying a small object, the authors proposed a system with structural and loss function optimization. The experiment was done

				with FDDDB and WIDERFACE and found that, in the proposed approach, face detection has a nice mix of accuracy and computational cost.
43	Zhu, Y. et al. [54]	2020	Tinaface based on Resnet	The author is of the view that generic object detection and face detection are similar and ASFD-D6, a face detector method that is extremely efficient and effective on the WIDER FACE dataset and achieved 92.4% AP compared to other state-of-art methods.
44	Ding, X. et al. [55]	2020	Deep Learning model	To detect swapped faces, the authors provided a comparison to human subjects by developing a website, differentiating real and fake images, and creating a swapped face dataset that can be used by the researchers for further research.
45	Mandal, B. et al. [56]	2021	Resnet-50	This paper focuses on identifying the people with face masks using deep learning. The authors used Resnet-50 architecture for training. When the faces are occluded, the performance of convolutional networks is bad
46	Al-ghanim, F. J. et al. [57]	2021	HOG and SVM Machine learning detector.	This paper proposed a method to detect faces with makeup under different conditions. The experiment was done with the DMFD dataset using HOG and SVM detector. This method achieved an accuracy of 99.3% in detecting the faces with make-up.
47	Rathgeb, C. et al. [58]	2021	Deep Face Representations M-PAD System	The authors conducted experiments on the MIFS database. The proposed model distinguishes makeup presentation attacks and genuine authentication attempts.
48	Lobo, V S. et al. [59]	2021	Explorative Study	Not only in terms of number and variety, but also in terms

				of an actual audience, the Indian entertainment industry has evolved, expanded, and is unique. The internet and outdoor entertainment appear to cater to two distinct public demands. Nowadays Yakshagana is becoming famous both in online and offline shows.
49	Naik, A. D. et al. [60]	2021	CNN and RNN, Geometric Deep Learning	The authors represented 3D images as point clouds by applying geometric deep learning to classify Indian classical dance forms including Yakshagana. Since CNN cannot be applied to non-Euclidean data, this model is proposed.
50	Somayaji, S. et al. [61]	2021	Explorative research	The author is of the view that many domains associated with Yakshagana necessitate technical research to assist artists and learners. The author discussed the necessity of adopting technology in preparing the ornament called Bhujakeerthi.

Deep learning has gotten a lot of attention over the last decade and has become a dominant AI technology. Object recognition is one of the most interesting aspects of deep learning and computer vision. In their paper, Hu, H., *et al* (2018) [62] proposed an object relation module to improve object recognition efficiency. It assesses the efficacy of object relationship modeling in CNN-based detection. Some of the papers related to object detection are reviewed on applications like face detection, pedestrian detection, etc. and analysis is done on the challenges and improvements in recent years in the area of object detection [63]. Zhao, Z. Q. *et al* (2019) [64] have given a review on a comprehensive overview of deep learning-based object identification frameworks that handle a variety of subproblems, including occlusion, clutter, and poor resolution, with varying degrees of R-CNN modification. According to Ghiasi, G., *et al* (2019) [65], NAS-FPN architecture achieved better latency and accuracy compared to the state of art object detection models. Zhao, J. X., *et al* (2019) [66] proposed a model to solve the problem of coarse object boundaries. EGNet was designed for salient object detection. With the use of salient edge characteristics, the salient object boundaries and localization are improved. In their paper, Tian, Z., *et al* (2019) [67] have proposed FCOS to tackle object recognition in a per-pixel prediction approach. This approach is anchor box-free and avoids the complications that occur during training. Zhou, X., *et al* (2019) [68] proposed a bottom-up approach to detect objects by grouping center and extreme points. This approach resulted in a competitive segmentation result on the MSCOCO data set. Qin, X., *et al* (2019) [69] proposed a modular novel end-to-end boundary aware model called BASNet for accurate salient object detection. According to Shao, S., *et al* (2019) [70], For object detection and semantic segmentation, Objects365 can be a better feature learning dataset. The capacity of Object365 to generalize has also been demonstrated on few tasks. In their paper, Brazil, G., *et al* (2019) [71] have proposed a technique to improve 3D parameter estimation. The proposed approach was successful in detecting 3D objects on the KITTI dataset. Pang, J., *et al* (2019) [72] have projected Libra R-CNN to improve the detection performance. It is observed that, on the difficult MS COCO

dataset, Libra R-CNN provides considerable improvements. For both two-stage and single-stage detectors, Libra R-CNN generalizes effectively to diverse pillars. To allow easy and fast multi-scale feature fusion, the authors Tan, M., *et al* (2020) [73] proposed a BiFPN pyramid network. EfficientDet, an object detector was developed and achieved more efficient results.

The task of executing real-time object detection with quick inference while retaining a base level of accuracy is known as real-time object detection. Many authors have researched real-time object detection and some of the recent researches is highlighted here. In their paper, Kim, K. H., *et al* (2016) [74] have presented an approach to achieving state of art accuracy in multi-category object detection tasks by reducing the computational cost using recent technical innovations. This approach can be used for sentiment analysis and face recognition along with object detection. Redmon, J., *et al* (2016) [75] have used basic YOLO to process images in real-time with 45 frames per second. But compared to state of art approaches, this method creates more localization faults and predicts false positives. In their study Mao, H., *et al* (2016) [76], offered a pipelined object detection execution on an embedded platform and found that Fast R-CNN is the solution for achieving high energy-efficient real-time performance. Huang, R., *et al* (2018) [77] have focused more on YOLO-LITE. In a variety of devices, this model has increased the accessibility of real-time object detection. It is found that, for lightweight real-time object detection networks, this model has several contributions.

For camera-based object detection, Ophoff, T., *et al* (2019) [78] have investigated an approach that increases the performance of single-shot detection networks. In both accuracy and localization of detection, this fusion model outperforms the baseline RGB network. In their paper, Lu, S., *et al* (2019) [79] proposed a real-time object detection algorithm for videos using the YOLO network. This approach improved the original YOLO algorithm with high detection speed but it is not effective in detecting small objects. Liu, L., *et al* (2019) [80] have designed a model for AR/MR systems. This model enables high accuracy in object detection and reduces false detection errors. Liu, Z. *et al* (2020) [81] have proposed Training-Time-Friendly Network (TTFNet) which aids in increasing the learning rate and speeding up the training process. This approach outperformed SSD3 and YOLOv3. In their paper, Jiang, Z., *et al* (2020) [82] have proposed YOLOv4-tiny. This model is best suited for real-time object detection in embedded systems and mobiles.

A facial recognition system is a piece of software that compares a human face in a digital image or video frame to a database of faces. It locates and measures face features from a given image, and it's widely used to verify individuals through ID verification services. Few recent kinds of research in this area by different authors are described here. In their paper, Masi, I., *et al* (2018) [83], have summarized advances in face recognition in the last five years in the area of computer vision and discussed SOTA training procedure, face processing part, transfer learning and verification, and identification in face recognition. Wang, F., *et al* (2018) [84] investigated the relationship between different types of noise, techniques to clean up data, including conducting large user research on the impact of data labeling strategies on annotation accuracy. On recent ten face recognition standards, including a new large-scale image database with trillions of pairs and a large-scale video dataset, Deng, J., *et al* (2019) [85], gave possibly the most complete investigational assessment against all current state-of-the-art face recognition systems. It is observed that ArcFace consistently outperforms the current state of the art and is simple to build with minimal computational overhead. In their research, Guo, G., *et al* (2019) [86], have highlighted problems related to face recognition by summarizing about 330 researches in this area. Although the accuracy of face recognition for various still image-based face matching has increased, there are still certain problems in practice. To maintain an equality of opportunity during the race of applying technology in face detection, Deng, J., *et al* (2019) [87] have defined light and large model tracks and released DeepGlint-Image with 1.8M images and IQIYI-Video with 0.2M videos data sets. Adjabi, I., *et al* (2020) [88] have presented views on the past of face recognition technology, the current trends, and the upcoming instructions. More concentration is given to 2D and 3D face recognition methods and deep learning approaches. In their research, Chang, J., *et al* (2020) [89] have proposed DULcls and DULrgs methods to maintain data uncertainty learning for face recognition and gave an in-depth investigation of how adding uncertainty estimation reduces the negative effects of noisy data and influences feature learning. In this paper, Wang, M., *et al* (2021) [90] have summarized and compared the most regularly utilized databases for model training and evaluation and reviewed miscellaneous scenes and technical challenges in deep face recognition. In the rapid advancement of deep FR approaches, a summary of different network designs and loss functions is suggested. In their

paper, Deng, J., *et al* (2021) [91] have focused on detecting faces with facial masks. The research also concentrated on detecting non-masked faces. Different top-rated methods are considered and work is still in progress.



Facial makeup has the power to change a person's appearance. The accurateness of automated face recognition systems, as well as methods for evaluating age and beauty from faces, may be harmed as a result of this change. The approach used by Chen, C., *et al* [92] uses a classifier to assess the presence or absence of makeup by extracting a feature vector that captures the shape, texture, and color features of the input face. In their paper Kotwal, K., *et al* (2019) [93] proposed a PAD procedure to recognize facial makeups and achieved an accuracy of 93% in identifying the facial makeups on the AIM dataset. In a face recognition system, Saeed, U., *et al* (2021) [94] investigated the effectiveness of illumination normalization strategies for reducing the fluctuations produced by cosmetics. Experiments on both confined and unconstrained databases reveal that lighting normalization approaches significantly improve face recognition results. In their research Alzahrani, T., *et al* (2021) [95] have conducted a comparative study and designed a automated system for identifying facial makeup from an image. Experiment was done with 2479-labelled images and four hundred and forty-six unlabelled images and achieved an accuracy of 88.33%. Gulati, K., *et al* (2021) [96] have designed a high-quality makeup recommendation system and contributed to the domain of this area. The work was appreciated by the users of this system. According to Ibsen, M., *et al* (2021) [97], face recognition systems are widely used in almost all areas to identify individuals. Few anomalies exists though many researches have taken place. To tackle with these anomalies, anomaly detection framework is designed and experimented on many databases and the system was successful in detecting the anomalies on images.

5. PRESENT STATUS :



At present, neither existing algorithms are used nor new algorithms are developed to identify the dressing styles or makeup styles to recognize the characters played by an artist. One has to go to *Chouki* (dressing room/green room) to get knowledge about crowns, ornaments, or jewels used. It is also very difficult to understand or identify the makeup styles used for different roles in Yakshagana. Visiting the dressing room and addressing the artist to gain information is the only option in the scenario. Just paying attention to the story or watching Yakshagana is not sufficient to gain thorough knowledge about Yakshagana. The audience should have a complete idea of how the dressing is done, what are the jewels or ornaments used, how the makeup has to do, and so on to understand Yakshagana completely. The audience without an idea about Yakshagana feels very difficult to follow the ongoing sequence. Therefore, to help the Yakshagana fans, we have identified the research gaps and came up with a research proposal with an ideal solution. Currently, there are no algorithms designed or developed and no existing algorithms on either object detection or facial recognition are used to identify crowns, jewels, makeup styles, and characters in Yakshagana.

There are different varieties of crowns available for different types of roles played in Yakshagana. The following table gives the descriptions of different types of crowns used in Yakshagana.

Table 2: Crown types







Type of Crown	Name (in the Kannada Language) & its Description
	Devi Kireeta (Mudi) This type of crown is used in characters like Devi, Vishnu, Bhoodevi, Laxmi, etc
	Naatakeeya Kireeta This type of crown is used for characters like Kamsa, Raavana, Bali, Hiranyakashyap, etc









		<p>Peta This type of crown is used for minister type of characters</p>
		<p>Pagadi This type of crown is used for young-aged characters like Abhimanyu, Agni, Varuna, Vayu, etc</p>
		<p>Kesari Thatti This type of crown is used for characters like Shumbha, Nishumbha, Raavana, Taarakasura, etc</p>
		<p>Turayi This type of crown is used for Prahlad, Lava, Kusha, Subrahmanya, Brahma, Vishnu, etc</p>
		<p>Bheemana Mudi This type of crown is especially used for roles like Bheema, Dushyasana, Ghatothkaj, Kumbhakarna, etc</p>
		<p>Kuttari Used for Shoorpankha, Taataki, Hidimbi, etc</p>
		<p>Dharmarayana Kireeta Used for Dharmaraya, Sugreeva, Hamsadhwaja, etc</p>
		<p>Hanumanthana Kireeta Used only for Hanuman character</p>
		<p>Kirana Used for all female roles</p>
		









		
		Kolu Kireeta Used for roles like Arjuna, Devendra, Hiranyaksha, Rakthabeeja, etc

Every type of character in Yakshagana has its unique style of dressing. Dressing looks beautiful with varieties of jewels. The following table lists some types of jewels used during the dressing.

Table 3: Jewel types

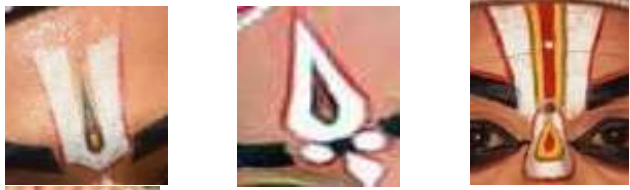
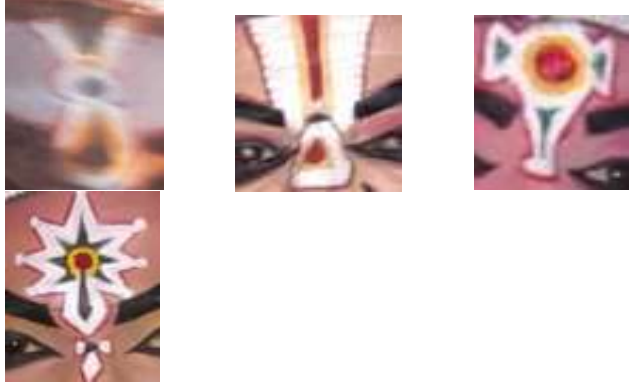
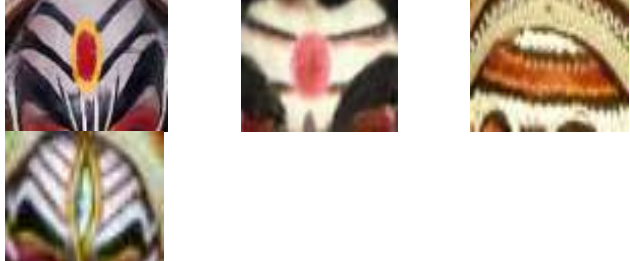
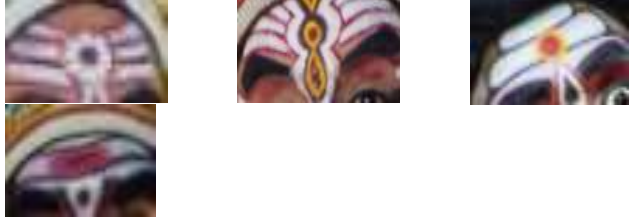
Type of Jewel	Name (in the Kannada Language)
	Kenne Hoo
	Karna Patra
	Bannada Veshada Ole
	Kai Kattu
	Tolu Kattu
	Bhuja Kattu

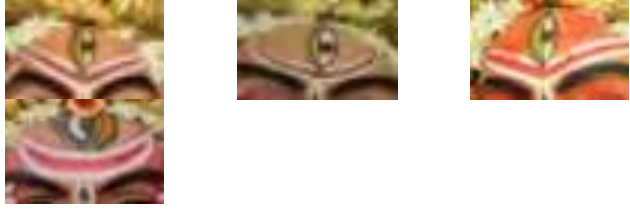
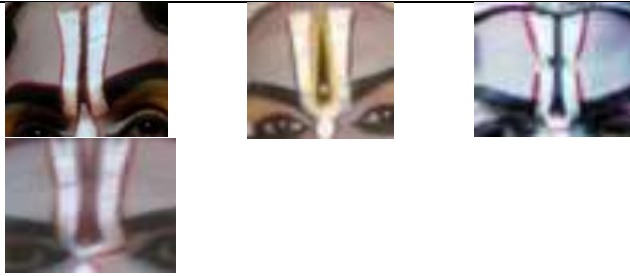
	Bhuja Kireeta
	Kai Kattu
	Dambe
	Agala Addige
	Mani Addige
	Mooguthigalu
	Soodi hoogalu (Gubbe)
	Sapooru Daabu

		Veeragase
		Jaalari Daabu
		Ullan Daabu
		Stri veshada mundale
		Stri veshada daabu
		Addige
		Kaalu Chendugalu
		Kaalu Gejjegalu

The actor has to do the makeup before dressing. For every character, different types of makeup styles or patterns are used. The Colour used during the facial makeup plays a very important role in identifying the characters on the stage. Make-up styles are predominantly classified based on whether the character is a follower of Lord Vishnu (called Vaishnavas) or lord Shiva (called Shaivas). If the character is a follower of Lord Vishnu then there will be a vertical line pattern with different color patterns on the forehead. If the character is a follower of Lord Shiva, then there will a horizontal line pattern on the forehead. Some types of makeup patterns are listed in the table below. This table lists only some types of makeup patterns because the makeup styles vary from artist to artist depending on his talent in makeup. But every actor has to follow the basic pattern style which includes either horizontal or vertical line patterns.

Table 4: Makeup styles

Few Makeup Patterns	Description
	<p>Here some makeup patterns are mentioned. Here we can note that there is a vertical pattern on the forehead in different styles. Some of the characters which follow these kinds of patterns are Devendra, Krishna, Abhimanyu, Sudarshana, Prahlad, Brahma, etc. All these falls under the Vaishnava role category.</p>
	
	<p>The makeup patterns mentioned here belong to the Shaiva category. Here the horizontal pattern is used on the forehead with different styles. Some characters that fall under this category are Veeramani, Bhandasura, Arunasura, Shankasura, etc.</p>
	

	<p>Some patterns used for Devi role</p>
	<p>Some patterns used for Vishnu, Rama, or Krishna roles</p>

In the above table, only some makeup patterns are mentioned. For every type of role, particular types of patterns must be followed by artists.

At present, the audience will just look into the play and are least bothered about the concepts involved in dressing styles and makeup styles. To understand Yakshagana in-depth, it is necessary to understand the concepts involved behind makeup styles, patterns, and dressing styles. In this survey, we have various types of patterns used in facial makeup, different swords used, distinct crowns, and diverse jewels used during the dressing.

To identify the character on it is very important to note down the facial makeup styles, the way of dressing, and the sword that is being used. Just considering only one parameter is not sufficient to identify a character. For example, the sword Bow and Arrow can be used for almost all types of characters. But there are some swords especially "Shree chakra" which is designed for Lord Vishnu. But in some circumstances, other characters like Goddess Devi may also hold the same sword. So, in these situations, one has to consider more than one parameter to identify a character. To address these complexities, there must exist a model which will make the audience identify the characters easily.

6. RESEARCH GAPS AND PROPOSAL :

Currently, there is a very insignificant amount of investigation on the application of technology in the Yakshagana field. More focus has to give to popularizing Yakshagana by making the people understand the concepts involved behind dressing and makeup styles. This survey identifies the following research gaps and suggests the ideal solution.

- **Research Gap 1:** Complexity in understanding and identifying the different types of crowns in Yakshagana image.

It is very much necessary to understand the different types of crowns used for diverse characters. There is huge scope for research to predict what type of crown is adorned by each character.

- **Research Gap 2:** Complexity in understanding and identifying the different types of jewels in Yakshagana image.

The Jewels used during the dressing is very specific, varies from character to character. There is a scope for research to predict the types of jewels used by each character.

- **Research Gap 3:** Difficulty in understanding and identifying the pattern in facial makeup in Yakshagana image is more challenging.

Facial makeup plays a vital role in predicting the character. To date, no research is done on this aspect to predict the character based on the makeup pattern.

- **Research Gap 4:** Difficulty in predicting the roles played by an artist based on dressing, makeup styles, and sword types.

One or more characters may follow similar patterns in facial makeup. In such cases, it is very difficult to identify the role played by an artist. In these complex situations, more than one parameter must be considered to identify a particular role. There is scope for the research to come up with a system to solve this complex situation.

• **Research Gap 5:** To identify the actual person who is playing the role. Once the actor is dressed up and finished with facial makeup, it is very difficult to identify the artist in person. Research is required if the audience wants to know the artist behind the role. Different machine learning or image processing algorithms can be used to achieve the above-discussed research gaps. Therefore, there is a huge demand for the best algorithms that provide the ideal solution for the above-stated research gaps. Based on the survey, it is observed that there is not much difference between object detection and face detection. Therefore, the algorithms based on CNN, RCNN, YOLO, Resnet, etc can be applied for detecting objects like crowns, jewels, swords as well as for detecting faces with make-up and without-makeup.

7. RESEARCH AGENDAS :

- (1) What conceptual model can be used to popularize Yakshagana by giving a technology touch to it?
- (2) Which technology platform or algorithms can be used to identify different varieties of crowns, jewels, and swords used in Yakshagana play?
- (3) What pattern matching algorithms can be proposed to identify the patterns used in facial makeup?
- (4) What technology can be used to identify the character played by an artist based on crown, makeup, and dressing styles?
- (5) What methodology can be proposed to encourage society to learn Yakshagana along with the technology?

8. LIMITATIONS OF THE PROPOSAL :

Every research has got its own set of limitations. Below is the possible list of limitations that may be considered in the future work.

- (1) This proposal is only limited to Yakshagana though our Indian culture is very vast. A similar kind of proposal can be developed for any other cultural area also.
- (2) This proposal only concentrates on *Mummela* though *Himmela* also plays a significant role in Yakshagana.
- (3) This proposal guides people on the appearance of character but it does not educate them with the dance steps they have to perform during the play though it is a part of *mummela*.
- (4) This proposal concentrates on identifying the character based on few parameters like crown-types, makeup-types and cosmetics. Though makeup looks similar for different characters in different plays, identifying the characters may be difficult. One may go for considering more features for classifying the characters.
- (5) This proposal identifies the character with simple make-ups. When the makeup is complicated this proposal may give false identification of characters.

9. SWOC ANALYSIS :

The goal of a SWOC analysis is to look at strengths, limitations, opportunities, and challenges in a systematic way [98]. Statistics, customer service ratings, and surveys can all be used to document strengths [99]. Weaknesses must be recognized and acknowledged so that they can be addressed quickly before they spread and cause widespread devastation [100]. External opportunities are common. They give businesses the tools they need to succeed [101]. Challenges can be overcome. Threats have the ability to harm a company, but challenges are often present and must be addressed wisely [102]. We conducted a SWOC analysis of the application of technology in the Yakshagana industry to experience its effectiveness.

Table 6: SWOC Analysis

Strengths	Weaknesses
Data availability Advancements in technology Vast audience reaches Wide demand from learners	Highly fragmented Human factor dependency Openness
Opportunities	Challenges

Viewership and Advertisement Scope for education Technical Advancements	Data protection, privacy law, and other legal issues Difficulty in analyzing unstructured data. Lack of quality content
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10. CONCLUSION :

Yakshagana is a popular folk theatre form found in the coastal districts. Many of the educational institutions in the coastal region included yashagana as an add-on course in their curriculum. Devotees or fans of yakashagana are also showing more interest in joining and learning Yakshagana through the private coaching centers. But the majority of these training centers or educational institutions teach only himmela and/or dancing steps of Yakshagana. The least importance is given to training people with dressing and makeup styles. Very rarely hands-on workshops were organized and are being conducted to give rough ideas on dressing and makeup styles. Our goal is to educate the people by giving technology touch to Yakshagana. Our research work concentrates on implementing a system using machine learning and image processing to educate the people on dressing and makeup styles which include classifying and identifying varieties of crowns, jewels, & swords. The proposed model also concentrates on predicting characters based on the facial makeup pattern and predicting the actor in the role. There is a huge scope for research to understand and find out an effective and reliable subset of technologies contributing to the development of Yakshagana.

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