# Symlet Algorithm for Highly Accurate Face Detection and Recognition in Comparison to Convolutional Neural Networks

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# Networks

**Abstract.** In order to get very precise face recognition and identification, the research contrasts the SYMLET method with CNN. Two examples are the Symlet algorithm and common neural networks (CNNs). There are a total of 40 participants; 20 will be in the SYMLET group & 20 will be in the CNN group.When determining sample sizes for this investigation, we used the following parameters: 80% pretest power, 0.05 alpha, and 95% confidence interval. With a significant value of P=0.001, the CNN method demonstrates an accuracy of 88.52% compared to the SYMLET technique's verification and accuracy of 50.13%. When compared to the SYMLET classifier, the findings show that CNN classifiers achieve far higher accuracy in face recognition & identification.

**Keywords:** Convolution Neural Networks, Face detection, Face recognition, SYMLET algorithm, Novel texture feature, Image Processing.

## INTRODUCTION

picture classification is a method of statistical analysis that groups visual elements or the whole picture into predetermined categories. An essential part of every picture classification system are classifiers and feature extraction [1, 2]. It is important to choose features appropriately and in a relevant way. Layers such as convolutional, pooling, rectified linear unit (ReLU), and fully connected ones make up a convolutional neural network (CNN). Over time, convolutional neural networks (CNNs) have developed with varying input picture dimensions, layer counts, stacking configurations, and layer orders. The sheer volume of features produced by CNN is its primary strength. Feature extraction & feature selection are both made much easier using CNN. Contrary to conventional neural networks, CNN does not use the characteristics that are hand-crafted [3].

Face detection and identification techniques have been the subject of research investigations. There were 13,70,000 articles found by Google Scholar and 18,800 research papers published by IEEE Explore. An analysis is conducted on face recognition utilizing several wavelet families and geometric distance measurements, as well as symlet & cosine angle distance measures [4]. To identify faces, symlet decomposition is used. Symlets, which are part of the wavelet family, split a single image into four smaller ones [5]. An improved convolutional neural network (CNN) design that incorporates batch normalization as a normalizing operation speeds up the network [6]. A significant improvement in performance is achieved by learning representations using deep learning [7].

In the current face and recognition system, it is difficult to determine which components are crucial for defining the face boundaries. By using the Symlet algorithm and CNN to accurately identify and analyze the main components that determine the face borders, a novel method for face identification & recognition is constructed, utilizing revolutionary statistical features. The study's overarching goal is to demonstrate how well the SYMLET algorithm can detect and identify faces. Members of our team have extensive experience working on research projects across a wide range of academic fields. [6]

## MATERIALS AND METHODS

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## Statistical Analysis

To quantitatively compare the efficacy of the Dyadic & Symlet algorithms, an independent sample t-test is used in SPSS version 21 [7].Accuracy is the dependent variable in this study, whereas image pixel intensities are the independent variables.

## RESULTS

Table 1 displays a comparison of the accuracy attained using CNN and the suggested Symlet. When comparing the two algorithms, Symlet comes out on top with regard to of accuracy.

The statistical evaluation of CNN & Symlet is shown in Table 1. Accuracy measures include mean, standard deviation, and standard error. Comparing CNN (88.5260) to Symlet (50.1310), the former is clearly superior.

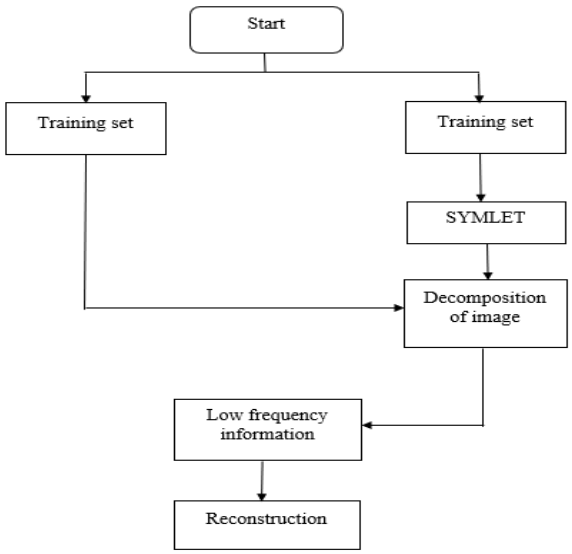
| Group | N | Mean | Std. Deviation | Std.Error Mean |
|---|---|---|---|---|
| CNN | 20 | 88.5260 | 1.61287 | 0.36065 |
| SYMLET | 20 | 50.1310 | 9.64148 | 2.15590 |

In Table 2, we can see how CNN and Symlet fared when it came to detecting and recognizing faces using new texture data.
Table 2. We used an independent sample test to compare the CNN and Symlet methods' accuracy means. The results show that the two methods have different average accuracy levels, with a value of.000, which is less than the significance level of $p < 0.05$.

| Leven's Test for Equality of Variance | | | | t-test for Equality of Variance | | | | | 95 % Confidence Interval of the difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | sig. | t | df | sig(2-tailed) | Mean difference | Std.Error Difference | lower | upper |
| Gain | Equal Variance assumed | 165.648 | .001 | 2.891 | 38 | .000 | 38.39500 | 2.18586 | 33.96996 | 42.82004 |
| | Equal variance not assumed | | | 17.565 | 20.063 | .000 | 38.39500 | 2.18586 | 33.83629 | 42.95371 |

The suggested symlet outperforms CNN with a much higher average accuracy value of 50.13%. After running the numbers on 20 samples, we find that cnn has a standard deviation of 0.051 and a standard error of 0.07, whereas Symlet has a standard deviation of 0.051 and a standard error of 0.06.

The process of face identification and recognition utilizing the Symlet algorithms by extracting unique texture characteristics is shown in the flow chart in Figure 1.




The first picture is decomposed using Symlet, and the low-frequency information is selected for reconstruction (FIGURE 1). Once the data has been rebuilt, it is subjected to multi-class categorization.

The algorithm starts by reading the provided facial data. Images used for detection using new texture characteristics and facial recognition are included in the training set. The CNN algorithm's flow for feature extraction is shown in Fig. 2.

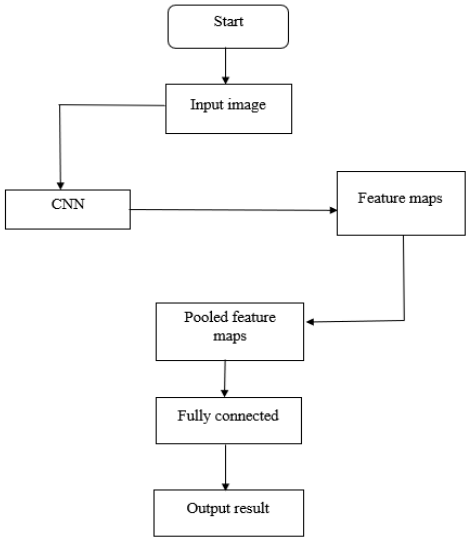



Figure 2 shows the hierarchical structure of a convolution neural network, which processes the input data with each layer before moving on to the next. To extract the most important data properties, such translation and rotation, each layer uses a convolution kernel.

Figure 3's bar graph shows that, on average, CNN achieves a higher feature extraction accuracy (88.52%) than the SYMLET method (50.13%).

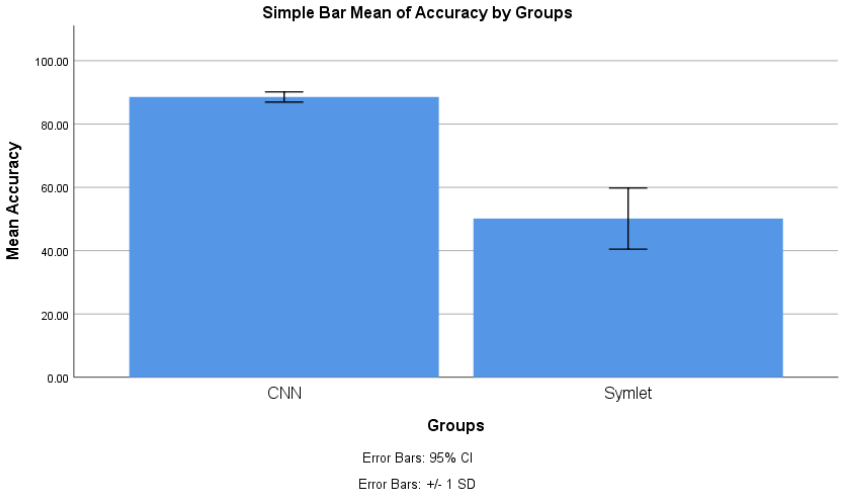



FIGURE3, a bar chart showing how CNN and Symlet compare in terms of mean accuracy. The CNN has a higher mean accuracy of 88.526% compared to the Symlet's 50.131%. Symlet versus CNN is shown on the X-axis, while the mean detection accuracy ± 1 SD is shown on the Y-axis.

## DISCUSSION

Tables comparing and averaging the data from Symlet and CNN are provided. After running the accuracy results of the Symlet and CNN algorithms using SPSS's Independent sample t-test, we can see their means, standard deviations, and standard error means. Twenty distinct picture accuracy scores, acquired using the symlet and CNN algorithms, are used to compute the mean.

A 90% success rate in facial recognition is attributable to deep learning-enabled CNN-based technology, which has quickly become the industry standard [8]. Using a regularization approach with an average accuracy rate of 92.81%, researchers tested CNN's ability to reduce overfitting results [9]. A CNN model achieves an accuracy of around 91% [10]. CNN has a 90% success rate in properly detecting emotions in images or videos [3].
The precision of the Symlet has been achieved by the use of facial recognition experiments [2]. A 92% recognition success rate was achieved by integrating symlet 2 wavelet with support vector machine [5].Using the Fisherface technique and Symlet decomposition, 91% of faces can be identified. The third. With an identification rate of 92.33%, the Symlet-6 closest neighbour classifier using the Cosine angle distance measure is the most effective [6].

One drawback of this research is that the suggested method's effectiveness degrades because of non-linear influences, such as variations in lighting, positions, and occlusions. So, going forward, the system is improved to the point where it can process face photos with occlusions, positions, emotions, and different lighting. This research has practical applications in the here and now.

## CONCLUSION

Compared to the Symlet classifier, CNN performs far better when it comes to face identification and recognition. Compared to CNN's average accuracy rating of 88.5260 percent, the suggested Symlet's average value of 50.1310 percent is much lower.

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