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TYPICAL STRUCTURE OF DATA COMPRESSION USING DETERMINATION OF LAYER WEIGHTS

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ABSTRACT

The neurons are structured in layers and connections are drawn only from the previous layer to the next one. A typical structure of this type of the neural network can be seen in What is making the neural networks interesting is that the determination of its weights is done by learning. A back-propagation is one of many different learning algorithms that can be applied for neural network training and has been used in this paper. Training data is divided into three different pattern classes; termination, bifurcation and no minutiae. The neural network output layer consists of three neurons, each representing one class of the training data. By training the neural network so it activates the right neuron corresponding to the pattern class, the classification of the input patterns can be achieved.

Keywords: Data Compression, Layer Weights.

I. INTRODUCTION

Extracting minutiae from the skeleton of the fingerprint requires a method that is able to distinguish and categorize the different shapes and types of minutiae. This is a classification problem and can be solved by constructing and training a neural network which work as a classifier [1-3]. Training of the neural network is conducted with the back-propagation algorithm. Neural network is a nonlinear mapping system whose structure is loosely based on principles of the real brain. The whole network is build up with simple processing units, structures. Size of the training data is chosen to 5 × 5 windows. The 3 × 3 window doesn't view much information and the 7×7 window show to much information which is unnecessary. Example on how the different sizes of the window results on the training patterns. The size of the window is deliberately odd so there is exactly one pixel in the center. A total of 23 different fingerprint skeletons have been used to collect the necessary patterns for the three classes. A total of 1951 different patterns have been gathered [4-7]. The different classes had 84 termination patterns, 388 bifurcation patterns and 1479 no minutiae patterns. Selection of the patterns was carefully done so the different minutiae types are found in the center. Even patterns with minutiae slightly off center are classified as no minutiae to avoid false classification towards that particular minutia type nearby. Examples of some patterns for each class can be. To find an optimal size and shape of the neural network for good realization, training test on various nets was conducted. To measure how fast the different neural networks learns a total error in each epoch has been calculate. The convergence of this error reveals how fast and good each neural network is. The error function that has been used where it is the error vector of the particular patter i in the training data set and is total number of patterns in the training data set. This function is called sum of squared errors and is normalized with size of the training set. Three neural networks were tested, two with single hidden layer and one with two hidden layers. The single hidden layers had 50 and 60 neurons respectively and two hidden layers had 25 neurons each. All neural networks was trained for 5000 epochs and then compared how fast and low the error falls. A graph with the error function calculated for each neural network is shown the target denotes one hidden layer with 50 neurons, it denotes one hidden layer with 60 neurons and it denotes neural network with two hidden layers with 25 neuron in each layer. It can be clearly seen that the neural network with two hidden layers converges fastest and lowest. The two single hidden layered are about the same. The interesting thing is to see how much improvement the extra hidden layer does.

II. METHODS AND MATERIALS

The diverse parts of the fingerprint verification system has been in depth explained. the performance evaluation of the developed system is in detail described and the experimental results are presented. This database was then used to evaluate the performance of the fingerprint verification system. The matching is divided into two groups; examination of the identical fingerprints and examination of the non-identical fingerprints. The data of interest is the percentage of matched minutiae and mean squared error. It can be seen that the cluster of the non-identical examples are some what directed. The smaller number of matched minutiae is, the smaller Ems gets. While with increasing number of matched minutiae, the Ems gets bigger. This is because the smaller number of matched minutiae offers better chance to be found closer to each other. While greater number of matched minutiae is often obtained by the minutiae distance matching method. The Ems is in this case strongly related to the value chosen for the distance threshold d1 in the matching algorithm. The bigger is the bigger Ems gets for the larger number of matched minutiae between the two non-identical fingerprints. This also explains why the non-identical cluster has greater overall Ems. Notice also the two examples of the non-identical fingerprints matching with very little percentage of the matched minutiae. This is due to the fact that fingerprints in those examples are that much different, that the matching algorithm found only one point pair in each. The cluster of the identical examples is rounder except the two examples closer to the 50% of the matched minutiae boundary. Usually this is because of the two identical fingerprints have smaller mutual area and therefore less minutiae are being matched together. The overall Ems is lower due to mutuality of the minutiae patterns that are being matched together. Figure 1 illustrate average of compression in ROSC field. The matched minutiae aligns better to each other and the Ems gets smaller. Analysis of the experimental results shows that the developed system is capable of separating the identical from non-identical fingerprints. The separation is mainly in the percentage of the matched minutiae part. By choosing the percentage of There should be at least one more checkup in form of examining the levels of the Ems. A threshold is introduced to specify the maximum tolerance of Ems that identical matched fingerprints can have. The threshold is chosen. This method should be considered as a minimum of requirements for separating the two clusters apart from each others. Furthermore, good separation of the two groups is highly depending on the threshold values chosen for the diverse algorithms. In the test most of the parameters specified during the paper reminds unchanged.

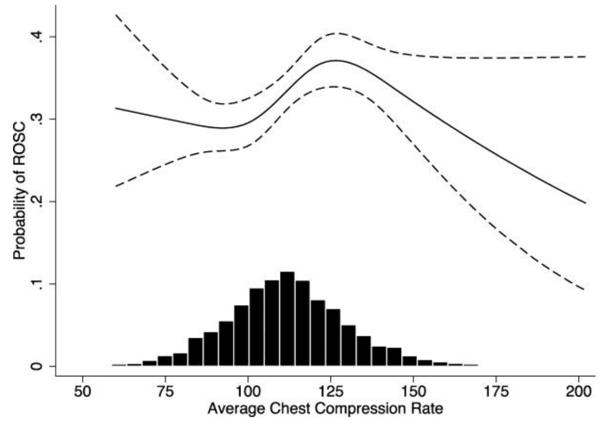

Figure 1 average of compression in ROSC field

III. EXPERIMENTAL RESULTS

The problem with two hidden layered neural network is that it can be easily over-trained; therefore training should not be longer then necessary. Finally the extraction of the minutiae from the fingerprint's skeleton is done by sliding the 5 × 5 window though the image. Each portion is then presented to the trained neural network which classifies it into one of the three classes. If the data sent to the neural network is a minutia coordinates (x, y) of the pixel in the picture are stored in a vector. The coordinates (x, y) represents the middle pixel in the window corresponding to the global coordinates in the picture. To speed up and make things easier in the extraction of the minutiae, an assumption is made. The portions of data that are viewed by the neural network are only those who have a black pixel in the middle. Since the minutiae are made only from the thinned lines there is no need to examine data where lines are off center in the data portion. This assumption gives three very good improvements. Extracted minutiae from the fingerprint are together forming a point pattern in plane. Therefore matching two minutiae point patterns with each other are considered as a 2D point pattern problem. An algorithm is needed that localize the maximum number of mutual points in the two point patterns. The algorithm described and a scientifc paper [7]. The point patterns are constructed only on positions (x, y) of minutiae in the plane. The minutiae type and orientation which provides extra information are disregarded due to possible type alternation and noise in orientation. The alternation can be caused by varying pressure between fingertip and the sensor and also by binarization process. Low pressure can cause that bifurcation minutiae appear as termination minutiae in the fingerprint image. On other hand high pressure can cause termination minutiae appear as bifurcation minutiae in the fingerprint image. Alternations of minutiae types by the binarization process has been pointed out . Bad quality of fingerprint image gives noisy orientation image and therefore false minutiae orientation. Alternation and false orientation of the minutiae gives higher risk that not all mutual pointes are detected. Since point patterns are based on positions of minutiae in fingerprint they form distinctive patterns. With enough points in each pattern the positions (x, y) of the minutiae are the only information that is needed for good matching. In the second pair of patterns P with 54 points and Q with 63 points is originating from two different people. The Q pattern is the same as in the previous example, only the P pattern has been changed. Selected from the fingerprints similar looking as the fingerprint in pattern Q. Figure 2 depicts percentage of compression in proposed method for 20% and 0%. Test is performed to see how many matching pairs the algorithm is able to detect. where in the upper row are the point patterns before matching. In the lower row are the point patterns after the matching has been completed and the boxes that have turned blue indicate found matching pair.

Figure 2 percentage of compression in proposed method for 20% and 0%

IV. CONCLUSION

The two fingerprints that are being matched should also have less than 50% of the difference in the number of minutiae. The larger difference in number of minutiae in the two point patterns is the higher chance there is to have higher number of matched minutiae. This is due to way the percentage of the matched minutiae is calculated, where the sizes of the minutiae patterns. Therefore, fingerprints with higher difference in number of minutiae gives better chance for higher percentage of the matched minutiae.

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