



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 12(D), pp. 30036-30038, December, 2018

**International Journal of
Recent Scientific
Research**

DOI: 10.24327/IJRSR

Research Article

BANKNOTE AUTHENTICATION SYSTEM UTILIZING DEEP NEURAL NETWORK WITH PCA AND LDA MACHINE LEARNING TECHNIQUES

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DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0912.2982>

ARTICLE INFO

Article History:

Received 6th September, 2018
Received in revised form 15th
October, 2018
Accepted 12th October, 2018
Published online 28th December, 2018

Key Words:

ANN, BPNN, PCA, LDA and Machine Learning

ABSTRACT

Banknotes are monetary standards utilized by any country to complete money related exercises and are each nation resource which each country needs it (certified receipt) to be real. A few reprobates present phony notes which look somewhat like unique note to make disparities of the cash in the money related market. It is troublesome for people to tell genuine and counterfeit banknotes separated particularly on the grounds that they have a great deal of comparative highlights. This paper proposes PCA and LDA techniques are utilized for dimensionality decrease and Back proliferation Neural Network (BPNN) classifier is utilized for confirmation of banknotes. Banknotes highlights are extricated dependent on primary segment examination (PCA) and straight discriminant investigation (LDA). PCA productively diminishes measurement of face pictures and speak to them with eigenfaces; while LDA is on the other hand used to enhance discriminant capacity of the PCA calculation. The principles given by BPNN are likewise tried and discovered that they are sufficiently exact to be utilized for banknotes expectation.

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INTRODUCTION

Regardless of a decline in the utilization of money because of the ongoing development in the utilization of electronic exchanges, money exchanges stay vital in the worldwide market. Banknotes are utilized to do money related exercises. The recognition and arrangement of phony or fake Banknotes from genuine ones is an imperative errand in each economy or society more often than not did utilizing distinctive methods. The recognition and characterization of phony or fake Banknotes from genuine ones is a critical errand in each economy or society more often than not completed utilizing diverse procedures.

To proceed with smooth money exchanges, section of produced banknotes available for use ought to be saved. There has been an extraordinary increment in the rate of phony notes in the market. Counterfeit cash is an impersonation of the certified notes and is made illicitly for different thought processes. These phony notes are made in all sections which brings the money related market of the nation to a low dimension. The different progressions in the field of scanners and duplicate machines have driven the scoundrels to make duplicates of banknotes. It is troublesome for human-eye to perceive a phony note since they are made with extraordinary exactness to resemble the other alike a certified note. Security parts of

banknotes must be considered and securities highlights are to be acquainted with alleviate counterfeit cash. Henceforth, there is a desperate need in banks and ATM machines to actualize a framework that groups a note as certifiable or phony.

This paper assesses Back proliferation neural system managed machine learning calculation to characterize certified and counterfeit notes, and contrasts and PCA and LDC calculations based on exactness, Precision and Recall. The framework should remove the highlights of the note utilizing picture handling methods. These highlights will be given as contribution to the machine learning calculation which will foresee if the note is valid or counterfeit. Banknote confirmation remains an imperative test for the national banks so as to keep the quality of the monetary framework around the globe, and to keeping affirmation in certainty reports, generally banknotes [1]. The scientists is portrayed a way for examination the validness of records, in banknote which include security of true reports, gainful on the security attributes of archives Which incorporate picture qualities that utilized for making the security reports.

Deterioration of test picture depends on a wavelet parcel change of the example picture. We had banknote confirmation dataset, these Data extricated from pictures. These dataset saved for the estimation of a confirmation ventures for banknote. Wavelets Transform actualizes were connected to

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mine highlights from pictures. Validation acquired through a stream of division and order measures. The pictures of banknotes are first divided in different parts, and afterward the consequences of characterization are group to accomplish the last banknote validation. Intrinsic calculation has been utilized to recognize legitimate and fake banknote. The methodology thinks about cash, the appropriateness isn't simple in the earth of Euro banknotes as this money teaches different ways to deal with keep away from duplicates henceforth numerous hypotheses on highlights and their area ought to be finished.

Deep Neural Network

Profound learning is a piece of Machine Learning and an extraordinary sort of Artificial Neural Network system (ANN) that looks like the multilayered human perception framework. Profound learning is at present picking up a great deal of consideration for its usage with huge social insurance information. Profound taking in, a procedure with its establishment in ANN, is rising as of late as an integral asset for machine picking up, promising to reshape the eventual fate of man-made reasoning. Profound neural systems characterize contributions to yields through an unpredictable piece of layers which present building squares including changes and nonlinear capacities. Presently, profound learning can take care of issues which are not really feasible with customary man-made consciousness [2]. Profound learning can use unlabeled data amid preparing; it is accordingly appropriate to tending to heterogeneous data and information, so as to learn and obtain learning [3] [4]. The utilizations of profound learning may prompt pernicious activities, anyway the positive utilization of this innovation is a lot more extensive.

Back Propagation Neural Network (BPNN)

The back engendering neural system calculation is a very basic one of the neural system. The calculation is the preparation or learning calculation as opposed to the system itself. Back engendering neural system calculation is a regulated learning strategy utilized for preparing ANN. Preparing is typically completed by iterative refreshing of loads dependent on the mistake flag. At that point the blunder flag is back proliferated to the lower layers. Back engendering is a drop calculation which endeavors to limit the blunder rate at every emphasis. The back proliferation strategy is a procedure utilized in preparing multilayer neural systems in an administered way. The back engendering technique, otherwise called the mistake back proliferation calculation, depends on the blunder adjustment learning rule [5]. It comprises of two goes through the distinctive layers of the system: a forward pass and a regressive pass. In the forward pass, a movement design is connected to the info hubs of the system, and its impact spreads through the system layer by layer. At long last, a lot of yields are delivered as the real reaction of the system. Amid the forward pass the synaptic loads of the systems are altogether settled. Amid the regressive pass, the synaptic loads are altogether balanced as per a mistake amendment rule. The real reaction of the system is subtracted from an ideal reaction to create a blunder flag. This blunder flag is then engendered in reverse through the system. The synaptic loads are changed in accordance with make the genuine reaction of the system draw nearer to the ideal reaction in a measurable sense. The load

modification is made by the summed up delta rule [8] to limit the mistake.

Principal Component Analysis (PCA)

Principal Component Analysis (PCA) technique [6] [7] is generally utilized for dimensionality decrease and recorded an incredible execution in face acknowledgment. PCA based methodologies can be partitioned in two stages: preparing and grouping. In the preparation stage, an eigenspace is built from the preparation tests utilizing PCA strategy. In grouping stage, an information confront is anticipated to the equivalent eigenspace and characterized by a suitable classifier, for example, Euclidean separation or Bayesian [3]. PCA encodes data in a symmetrical direct space while the Linear Discriminant Analysis (LDA) technique encodes unfair data in a straight detachable space of which bases are not really symmetrical.

In this paper, the PCA and LDA techniques are utilized for dimensionality decrease and feed forward neural system (FFNN) classifier is utilized for grouping of appearances. The proposed strategies are called PCA-NN and LDA-NN individually. The techniques comprise of two stages which are the PCA or LDA preprocessing stage, and the neural system arrangement stage. The proposed frameworks indicate enhancement for the acknowledgment rates over the ordinary LDA and PCA confront acknowledgment frameworks that utilization Euclidean Distance based classifier. Principal part investigation (PCA) and direct discriminant examination (LDA) [7] and discrete cosine change (DCT) are three fundamental procedures utilized for information decrease and highlight extraction in the appearance-based methodologies.

Linear Discriminant Analysis (LDA)

Linear Discriminant Analysis (LDA) is directed dimensionality decrease procedure dependent on a straight projection from the high dimensional space to a low dimensional space by expanding the between class dissipate and limiting the inside class disperse. LDA is otherwise called Fisher's direct discriminant. It is for the most part utilized as an element extraction venture before arrangement and gives dimensionality decrease of highlight vectors without loss of data. LDA calculation chooses highlights that are best for class distinctness while PCA chooses highlights critical for class portrayal. PCA and LDA are two incredible assets utilized for dimensionality decrease and highlight extraction in the greater part of example acknowledgment applications.

Experimental Results

We have considered the Banknote validation Data Set from the UCI Machine Learning Repository information [9] to assess PCA, LDA and BPNN. The examinations have been led by utilizing Python programming dialect. The Python Scikit-learn is a bundle for information order, relapse, grouping and representation. The Banknotes informational collection has 1372 lines and 5 attributes. The objective class contains two qualities: 0 and 1 where 0 speaks to certified note and 1 speaks to counterfeit note. In characterization issues how class names are conveyed. So in this information there are two class names i.e., The Authentic class has 762 occasions and Forged class has 610 examples.

DISCUSSION

In the learning stage, the models are prepared with 70% information i.e. 960 examples out of which 527 examples were of authentic notes and 433 were of phony notes. For testing the models, staying 412 examples have been utilized, where 235 examples were of veritable notes and 177 examples were of phony notes. The framework assesses the execution of two dimensionality decrease models (PCA and LDA) with disarray grids and results have been appeared Table 1 and Table 2. The qualities to gauge the execution of the techniques (i.e. Correctness’s, exactness and review) are gotten from the disarray framework and the general outline of the three techniques is recorded in table 3 and same appeared graphical portrayal in figure 1.

Table 1 confusion matrix of Banknotes Test Data

BPNN Algorithm Test Data (412)				
		Predicted		
		Authentic	Forged	
Actual Class	Authentic	213	22	
	Forged	0	177	

From the confusion matrix of table 1, we can see that out of 412 test instances, BPNN algorithm misclassified only 22.

Table 2 confusion matrix of Banknotes Test Data

BPNN with LDA Test Data (412)				BPNN with PCA Test Data (412)			
		Predicted				Predicted	
		Authentic	Forged			Authentic	Forged
Actual Class	Authentic	233	2	Actual Class	Authentic	229	3
	Forged	2	175		Forged	2	178

From the confusion matrix of table 2, we can see that out of 412 test instances, BPNN with PCA algorithm misclassified only 5. The BPNN with LDA algorithm misclassified only 4.

Table 3 Performance summary of the three methods

S.No	Classifier	Accuracy	precision	recall
1	BPN	95.83	95	95
2	BPN with PCA	98.78	98	98
3	BPN with LDA	99.02	99	99

Figure 1 delineates the chart that demonstrates the examination of BPNN with two dimensionality decrease (PCA and LDA) procedures as far as various parameters. We saw in the figure-1 just BPNN got 95.83% exactness. While BPNN with PCA has 98.78% exactness and the BPNN with LDA has accomplished 99.02% precision. By contrasting arrangement aftereffects of BPNN and LDA method gives better outcome as far as exactness i.e., 99.02%.

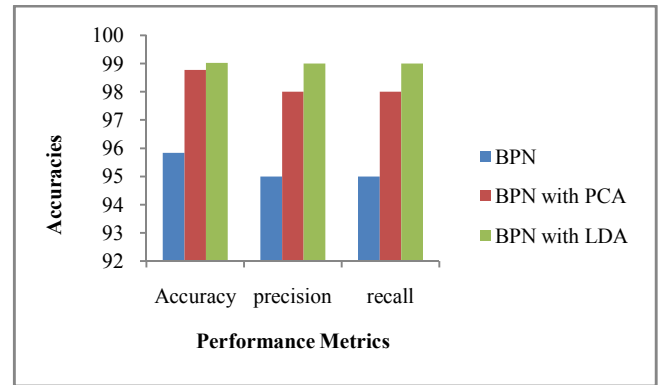


Figure 1 Performance summary of the three methods

CONCLUSION

In this paper, Banknote confirmation recognizable proof execution utilizing PCA, LDA and BPNN is researched utilizing the Database of banknotes. In the wake of dissecting different strategies used to distinguish produced banknotes, this paper presents banknote confirmation for perceiving the banknote as real or phony by utilizing BPNN with LDA and PCA procedures. PCA is utilized to lessen measurement of monstrous face information while LDA enhances its separation capacity. Broad analyses have been performed on banknotes dataset utilizing both the models (PCA and LDA) to locate the best model reasonable for characterization of the notes. The outcome demonstrates that BPNN with LDA beats with the BPNN with PCA and gives 99.02% achievement rate. These methods are a productive method for tackling the issue for all keeping money machines that acknowledge a wide range of notes.

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