Faculty of Home Economics

Journal of Home Economics
Print ISSN: 2735-5934, Online ISSN: 2735-590X
Menoufia University, Shibin El Kom, Egypt
https://mkas.journals.ekb.eg

Clothing And Texttile

Article Type
Original Article

Author Affiliation:
Garment Department ،- Sammanoud Technological University, Egypt

Textile Research and Technology stitute, National Research Center, ɔkki, Cairo, Egypt.

Corresponding author:
Wagdi Elsisy
dr_wagdielsisy@hotmail.com
Mobile: +2 01019787003

DOI:10.21608/mkas.2023.201239.1216

Cite as:
Wagdi Elsisy, 2023, Predicting the Performance of Air-Jet Weaving Machine in Relation to Filling Yarns' Twist Loss Using (ANN) and Linear Regression Models. J Home Econ. 33(2), 235-248.

Received: 21 Mar 2023
Accepted: 20 May 2022
Published: 1 Apr 2023

Printed in Menoufia University, Egypt.

Predicting the Performance of Air-Jet Weaving Machine in Relation to Filling Yarns' Twist Loss Using (ANN) and Linear Regression Models

Authors
Alsiad Almetwally [1, 2] , Wagdi El-sisy[1]

Abstract:
During their insertion on Air-Jet weaving machines, the leading end of the filling yarns lose some of their twist values. The loss of twist amount is around 10-15% of the nominal twist. This amount of lost twist will adversely affect the performance of this type of weaving machine, and also deteriorates the physical properties of the produced fabrics. In this study, the amount of lost twists in the weaving yarns on Air-Jet weaving machines was predicted using two different methodologies, namely regression and Artificial Neural Networks (ANN). The predicted models were derived and compared for both methodologies. The efficiency of predicting power was also evaluated using the coefficient of determination (R2 value), mean bias error (MBE), and Root Mean Square Error (RMSE) for both models. It is evident that R2 values have high values and the remaining parameters have low values for the ANN technique in comparison with regression one. This means that the ANN technique is more efficient in predicting than regression.

***Keywords**: Air-jet, weaving machines , filling yarns , twist loss , fabric properties , regression analysis , artificial neural networks*

Introduction

Since the last four decades, and especially since the (ITMA) 1979 exhibition, air-jet weaving machines have gained much attention in comparison with all other weaving machines. The main feature of this type of weaving machines is that because of the freedom of the leading end of the weft yarn it is capable to untwist during its insertion in the weaving shed. This twist loss of filling yarns will vary across the fabric width and it is significantly affected with filling yarn and machine parameters. The value of this twist loss will also significantly affect the woven fabric properties.

The subject of filling yarn twist loss on Air-let weaving machine has been researched on a fewer and limited numbers of papers over the last years. Talavasek and Savty [1] were the first ones who mentioned the subject of twist loss on Air-jet weaving machine on 1981. After that a method for measuring twist loss and its distribution on Elitex, Maxbo and Japanese Air-jet looms was described [2]. This method revealed that that the weft yarn loses about 7% to 11% of its nominal twist on the right hand side from the main nozzle. While on the left hand side of the main nozzle, the weft yarn is either losing or gaining a little quantity of twist. The retained twist of weft yarns during weaving the corduroy fabrics on modern air-jet loom was also investigated [3]. Because of the free leading end is subjected to untwisting for longer time than the rest of the pick, It was confirmed that the lowest value of the retained twist takes place at the fabric selvage away from the main nozzle. This retained twist loss was varied across the fabric width and mainly depends on filling yarn count and the nominal twist in the filling yarn. Also, a comparison between open-end and ring spun yarns with respect to their twist loss during insertion on Air-jet weaving machine was conducted [3]. It was found that the difference between the two types of yarns in terms of retained twist was not significant.

On other research works, the subject of twist loss of open-end and ring spun weft yarns during their insertion on Air-jet weaving machine were investigated in more details [4-6]. The effects of Air-jet weaving machine parameters such as distance from the main nozzle, main nozzle timing, air pressure of the main nozzle and machine type and weft yarn parameters, i.e. yarn twist factor, and weft yarn count on twist loss were examined. The effect of twist loss on woven fabric properties was also investigated extensively.

In recent years, twist loss of weft yarn on Air-jet weaving machine still under discussion. The relay nozzle type and its effect on weft yarn twist loss on Air-jet weaving machine were recently investigated [7]. It was found that multi-hole relay nozzle resulted in higher twist loss than the single-hole relay nozzle. It was also found that fabrics woven away from the main nozzle has a lower tensile strength compared to those woven at the left hand side. Air pressure of the relay nozzles was also found to correlate directly with the twist loss in the weft yarn [7]. The effect of weave structure, weft yarn type and fabric width on twist loss on air jet weaving machine were also examined [8, 9]. It was revealed that wider fabric retained lower twist compared to narrow one.

Regarding the textile industry, there were numerous research works that were used to optimize, predict the characteristics, performance and quality of textile products, whether fibers, yarns or fabrics, using regression models and artificial neural networks [10-16]. However, and to my knowledge, there is no research work concerning the prediction of twist loss on Air-jet weaving machines as one of the key factors determining the performance of this type of weaving techniques. This paper is undertaken to predict Air-Jet weaving machine performance with respect to the twist loss of weft yarns during their insertion in the weaving shed. Also, the prediction process was conducted and compared by using two different prediction techniques, namely regression and ANN techniques. It is worth noting that the experimental work of this study was performed at the National Research Center, Dokki, Cairo., Egypt.

2-Experimental work

2-1: Materials and methods

In this study, three yarns with English counts (Ne), namely 16 Ne, 20 Ne, and 30 Ne from Egyptian cotton of type Giza 86 were spun under similar kinematical and technological parameters on a ring spinning machine of type Platt Saco Lowell. It should be noted that each yarn count was produced using two twist multipliers i.e. 3.8, and 4.2. The particulars of the Egyptian Giza 86 cotton were listed in table 1, and the characteristics of the used ring spinning machine were also presented in table 2.

Table [1]: Particulars of the used Egyptian cotton of type Giza 86.

Property	Value
Upper Half Mean Length (UHM)	31.8 mm
Regularity Index	86
Tenacity	42.6 g/tex
Elongation	4.9%
Micronaire value	3.87 μg/inch
Maturity ratio	79%
Fineness	159 millitex

Tble [2]: Parameters of the used ring spinning machine.

Parameter	Value
Type of drafting system	Mechanical
Load on the delivery roller	13 dN
Back draft	1.2
Drafting gauge	56mm/70mm
Spindle gauge	70 mm
Spindle speed	11000 rpm
Ring diameter	45 mm
Traveller count	15
Traveller type	EL1 fHW,15/0
Traveller speed	25 m/s
Delivery speed	15 m/min

After spinning, the ring-spun yarns were inserted as fillings on a Picanol Air-jet weaving machine with a profiled reed and auxiliary. Also, the ring-spun yarn properties which were used throughout this study were listed in the following table (table 3).

Table 3: Properties of the used ring-spun yarn during this study.

Yarn count (Ne)	Twist factor	Hairiness Index	Tensile strength (grams)	Breaking elongation (%)	RKm	Total imperfection Index
16	3.8	9.8	760	6	20.6	95
	4.2	9	810	6.6	21.9	102
20	3.8	8.4	610	5.5	20.7	122
	4.2	7.7	660	6.2	22.4	119
30	3.8	6.8	415	5.2	21.1	446
	4.2	6.2	445	5.6	22.6	495

To investigate the effect of weaving machine parameters on the filling yarn twist loss during its insertion, the machine parameters to be varied include timing of the main nozzle (m sec), air pressure of the main nozzle (bar), and weaving machine speed (rpm). In addition, the twist factors of weft yarns, and their counts were also intended to be examined. Finally, the distance of the woven fabric away from the main nozzle in centimeters was also investigated. The investigated variables and their levels were tabulated in table 4.

Table [4]: Examined variables and their levels

Variables and codes	Variable levels (codes and values)				
	-2	-1	0	+1	+2
Timing of main nozzle (X1)	8				16
Air pressure of main nozzle (X2)	3				5
Twist factor of filling yarn (X3)	3.8				4.2
Distance away from the main nozzle (X4)	18	48	80	112	144
Weft yarn count (X5)	16		20		30
Weaving machine speed (X6)	620				760

As shown in the above table, six variables were addressed. Of these, there are four variables with two levels each, one variable with five levels, and one variable with three levels. Therefore, the factorial design conducted during this study was in the form of $2^4 \times 5 \times 3$, which means that the total runs in this study are equal to 240. If each run was replicated twenty times, thus the total number of observations used in this study was approximately 240 × 20= 4800 observations.

As the twist loss of the filling yarn is the output variable on the weaving machine that will be examined, it was evaluated and measured accurately. Throughout this study, the twist loss was measured by subtracting the value of twist (number of turns per meter) for filling yarns after raveling them from the woven fabrics and the value of twist for ring-spun yarns before being woven into fabrics. The measured twist loss for each run (treatment) was repeated twenty times and their average values were calculated. It is worth noting that the twist loss was measured and evaluated using Zweigle twist tester according to ASTM D1423/D1423M-16(2022).

2-2: Artificial neural network (ANN)

2-2-1: Determining the number of neurons in the hidden layer

In order to identifying the optimal number of neurons in the hidden layer, the mean square error (MSE) as a performance index of the neural network was calculated at different numbers of neuron in the hidden layer. Generally, the lower the mean square error value, the higher is the performance of the neural network. The relation between the number of neurons in the hidden layer and the performance of the neural network in terms of mean square error was depicted in the figure 1.

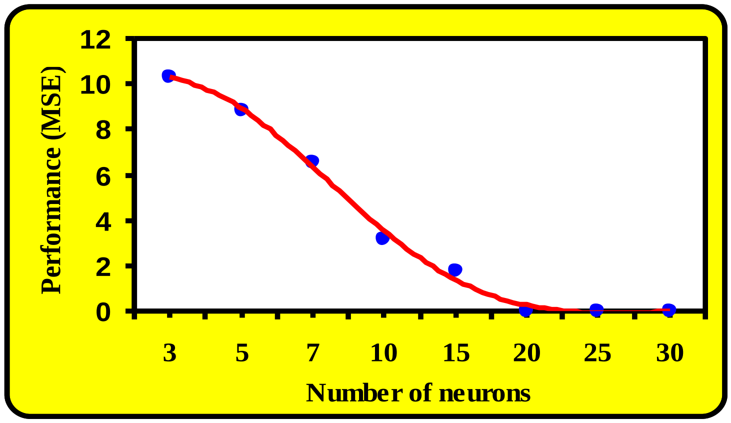


Figure (1): Relationship between the number of neurons in the hidden layer of the artificial neural network and its performance

From this figure a decreasing trend was detected assuring that as the number of neurons in the hidden layer increases, the mean square error decreases. In other words, as the number of the neurons increases, the performance of the neural networks improved significantly. It was also detected that the substantial decrease in the means square error, higher increase in the neural network performance, has been occurred with increasing the number of neurons from 3 to 20 neurons which corresponds to mean square values of 10.3 and 0.032. A slight decrease in the mean square error from 0.032 to 0.001 with increasing the number of neuron from 20 to 30 was also detected. This means that the optimal number of neuron the hidden layer of the artificial neural network under study will be 20 neurons.

It is worthily noted that increasing the number of neurons in the hidden layers too much will lead to complicate the performance of the neural network. Thus it is better to exclude using 30 or even 25 of neurons, and we will only use 20 neurons in the hidden layer.

2-2-2: Artificial neural network architecture, performance and training.

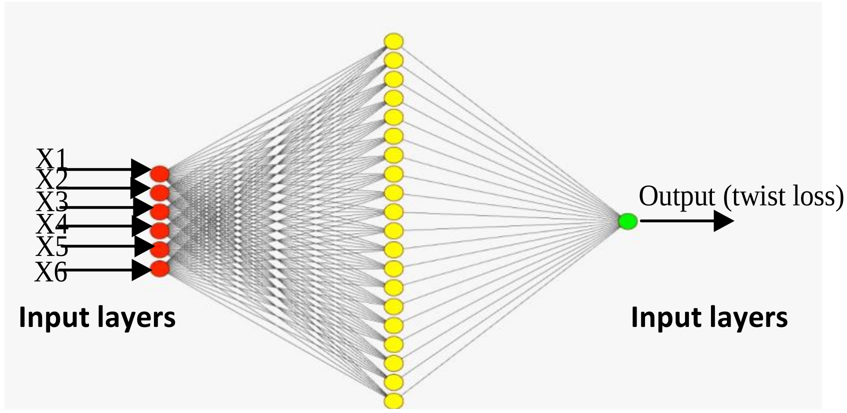
Absolutely, the ANN structure for the present study consists mainly of three layers; these are as follows:

1- The input layer composed of six nodes corresponding to the six input variables. X1 to x6 control variables denote main-nozzle timing, air pressure, twist factor of the filling yarns, distance from the main nozzle, weft yarn count, and weaving machine speed respectively.

2- The hidden layer composed of twenty nodes according to the performance experiment conducted above.

3- The output layer which consists of one node corresponding to twist loss on Air-Jet weaving machine. It should be noted that twist loss was evaluated in terms of the number of twists lost per meter.

The schematic diagram of the backpropagation neural network utilized in this study was depicted in figure 2.



Figure(2) Schematic representation of backpropagation neural network used in this study

2-3: Performance evaluation

The prediction accuracy which is the most important measure of performance of the predicting models can be calculated based on the training data [10]. The predicting error which represents the accuracy measures of the predicting models is measured using the difference between the actual values and the predicted ones. . In order to estimate the performance of ANN and regression models, four accuracy models were evaluated according to the following equations:

2-3-1: Root Mean Square Error (RMSE)

RMSE provides information about the short term performance which denotes the variation of predicated values around the actual values. The closer the mean root square error to zero is, the better is the performance of the predicting models [11].

2-3-2: Mean Bias Error (MBE)

MBE is considered an index for the average deviation of the predicted values from the measured ones. It can also give information about the long term performance of the predicting models. If the value of MBE approaches zero, this means that the predicting models have a high accuracy [11].

2-4: Regression analysis

Analyzing and modeling of twist loss on Air – Jet weaving machine as a function of pre-described independent variables was implemented via regression analysis. The simplest form of multiple regression models is the linear one.

It is worth noted that the experimental results used to derive the multiple regression model is used typically to evaluate the performance of ANN. In the multiple linear regression model, the dependent variable is the twist loss on Air-Jet weaving machine and the independent ones are main nozzle timing (m sec), air pressure of main nozzle (bar), twist factor of the filling yarn (α_e), distance from the main nozzle (cm), weft yarn linear density (N_e) and weaving machine speed (rpm).

The following multiple linear regression model correlate the twist loss on Air-jet weaving chine with the independent variables is:

Twist loss (turns/m) = - 87.95 – 0.98 × timing + 7.88 × pressure + 27.3 × twist factor +0.42 × distance - 0.3 × count – 0.1 × speed

As seen from this regression model, main nozzle timing, weft yarn count and running speed of the weaving machine affecting the twist loss on Air-Jet weaving machine negatively; whereas twist loss is affected positively by air pressure of main nozzle and the twist factor of the weft yarn. Generally, regression summery of the dependent variable, i.e. twist loss of weft yarn, was presented in table 5. From this table it can be observed that the timing of main nozzle, weft yarn count and weaving machine speed accounted for 16.5%, 8% and 15% of the effects on the weft yarns twist loss during their insertion on Air-Jet weaving machines and they all have a negative influence. Also, air pressure of main nozzle, twist factor of the weft yarns and the distance from the main nozzle they were found to account for 32%, 23% and 78% of the effects on twist loss, whereas they all have a positive influence. The values of the p-level shows that all the independent variables have a high significant impact on the twist loss at 0.01 significant level. Thus it was proved that any of the independent variables cannot be excluded from the regression model.

Table [5]: Regression summery of twist loss

	Beta	Std. Err.	B	Std. Err.	t(233)	P-level
Intercept			-87.9545	14.4662	-6.0799	0.0000
X1	-0.1650	0.02597	-0.9891	0.1556	-6.3554	0.0000
X2	0.3208	0.02599	7.8811	0.6386	12.3408	0.0000
X3	0.2319	0.02600	27.8023	3.1161	8.9220	0.0000
X4	0.7918	0.02596	0.4194	0.0137	30.4999	0.0000
X5	-0.0800	0.02602	-0.3036	0.0987	-3.0737	0.0023
X6	-0.1521	0.02597	-0.0521	0.0088	-5.8601	0.0000

3- Results and discussion

Throughout this study, a three-layer neural network comprises six-input layer, a twenty neuron hidden layer and one-neuron output layer, focusing on the twist loss (turns/m) of the weft yarns during their insertion on Air-jet weaving machine. The learning model of the neural network is in accordance with the experimental data of six inputs and one target output.

The coefficient of determination (R^2 value), Root Mean Square Error (RMSE) and Mean Bias Error (MBE) were used to validate and verify the performance of the regression and ANN models.

The actual and predicted values of twist loss of the weft yarns during their insertion on Air-Jet weaving machine via ANN and regression models and their performances were presented in Tables 6 and 7and in Figures 3 and 4 respectively. The results revealed that the performance of ANN model is superior to the corresponding regression one in terms of RSME, MBE and R^2 values respectively. It is worth noting that the lower values of RMSE and MBE and the higher values of R^2 are the best. The values of RMSE for ANN and regression models were 0.179 and 9.724 respectively. Whereas, mean bias error for ANN and regression models were found to be 0.1198 and 7.7288 respectively. The lower values of RMSE and MBE associated with ANN model indicates also the excellent power of the model prediction.

It was also observed that the coefficient of determination values (R^2 values) of ANN and regression models were 0.958 and 0.843, respectively. The values of R^2 indicated that 4% of the variation in the twist loss on Air-Jet weaving machine was not explained by ANN model, whereas the regression model did not explain about 16% of the variation in the twist loss. All these results signify that ANN model fits and represents the experimental data very well and it can be used to predict the values of the twist loss of the weft yarns during their insertion on Air-jet weaving machine more efficient than the multi-linear regression model.

From Table 5, it can be seen that the absolute error of the ANN model ranges between 0.015% and 1.742%, while the prediction error of the experimental data that are predicted using the regression model varied between 5.2% and 25.4%. These values confirm that the predictive performance of the ANN model is outperformed than the regression model in the prediction of twist loss on the Air-Jet weaving machine.

Table [6]: Actual, predicted and the absolute error values of weft yarn twist loss using ANN and regression models:

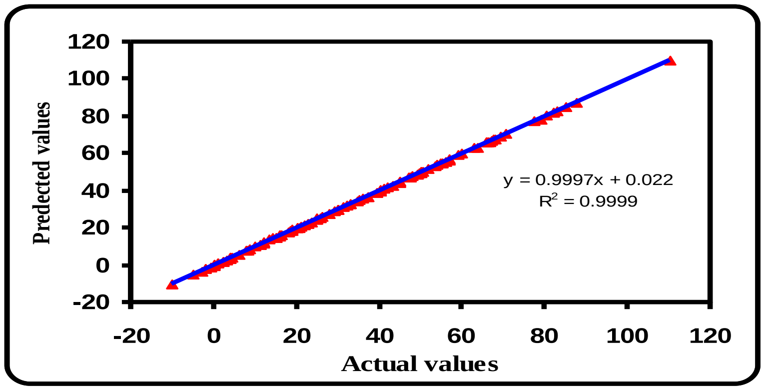
Actual value (turns/m)	Multi-linear regression		ANN	
	Predicted value	Absolute error (%)	Predicted value	Absolute error (%)
11	12.29969	11.81536	10.80839	1.741943
20	18.23052	8.8474	19.98167	0.09166
33	34.71802	5.206121	32.91645	0.253178
40	29.8501	25.37475	39.81021	0.474471
50.5	56.64861	12.17547	50.50784	0.015517
57	68.3231	19.86504	57.02734	0.047957
66	72.41079	9.713318	66.51433	0.779287
77.5	83.5317	7.782839	77.74106	0.311046
87.4	82.3175	5.81524	87.37631	0.027111

Table [7]: Prediction performances of ANN and regression models for the twist loss on Air-Jet weaving machine

Statistical parameters	Regression model	ANN
Coefficient of determination, R2	0.843059	0.957727
Root Mean Square error, RMSE	9.724471	0.179243
Mean Bias Error, MBE	7.728832	0.119814

The predicted outputs of multi-linear regression and ANN models versus the actual experimental values of twist loss of the weft yarns on the Air-Jet weaving machine were depicted in Figures 3 and 4 respectively. From these figures, it can be seen that the trend of the predicted outputs using the ANN model was better than those predicted using the regression model. This means that the ANN model capable of predicting the twist loss on the

Air-Jet weaving machine more efficiently than the multi-regression model. The correlation coefficients between actual and predicted values of twist loss using ANN and regression models were 0.92 and 0.99 respectively.



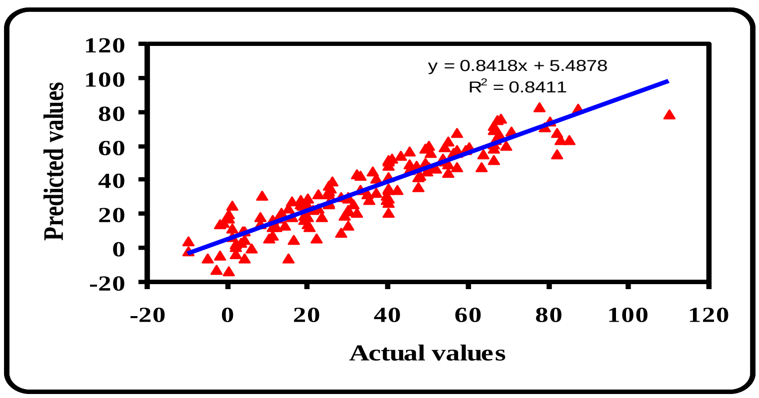


Figure (3): Actual versus predicted vales using ANN model for twist loss of the weft yarns on Air-Jet weaving machine.

The obtained Gaussian curves for ANN and regression models were plotted in figures 5 and 6 respectively. The predictions using both the proposed models were detected using the normal distribution of the frequency. The horizontal axis indicated the residuals, while the vertical axis represents the corresponding frequency (No. of observations). From these figures, it is evident that the mean and the mode have coincided with each other. The coincidence of mean and mode means that the model is more precise in prediction. On the other hand, the Gaussian curve in the regression model is wider than those in the ANN model; which means that the variation of predicted values using the regression model is more than those predicted with the ANN model. Also, it is shown that normal curve associated with the ANN model is slightly more symmetric than that associated with the regression model. This confirms that the ANN model is more efficient in predicting twist loss than regression one.

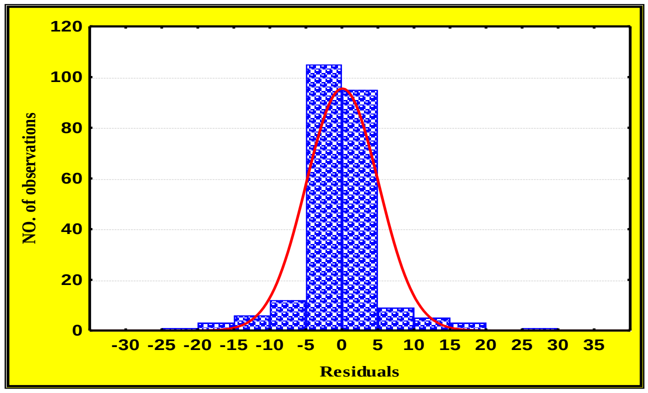


Figure (5): Histogram and Normal distribution curve for ANN mode

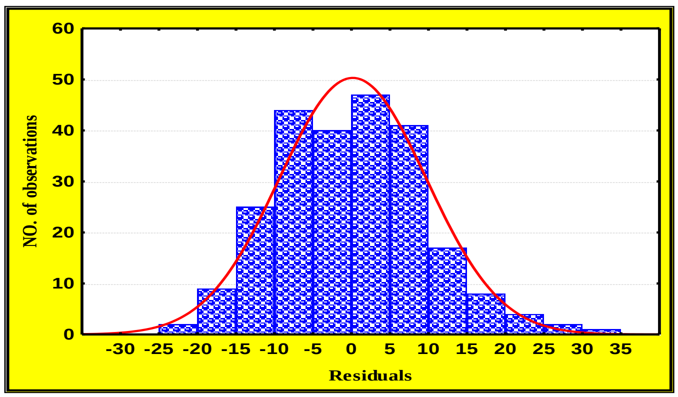


Figure (6): Histogram and Normal distribution curve for regression model

Box plots are useful for evaluating and comparing the distributions from which the predicted values were derived. Also, the outliers from each predicting model can be detected. Generally, box plots rely on 25th, 50th, and 75th percentiles in the experimental values obtained from the distributions. The 25th and 75th percentiles which are also called first (Q1) and third (Q3) quartiles represent the lower and upper hinges. While the 50th represents the median (Me) of the predicted experimental values. On the box plots, outliers and extreme values were also introduced. Outliers are observations or predicted values greater than the value of Q3+1.5*IQR or smaller than Q1-1.5*IQR. Whereas the extreme values are corresponding to the observations greater than the value of Q3+3*IQR or smaller than the value of Q1-3*IQR.

It is worth noting that the box is trapped between Q_1 and Q_3 and it is also internally split by the median value (Me). Additionally, to obtain extra information about the spread of the experimental data, whiskers are also drawn. The whiskers extend from upper (Q_3) and lower (Q_1) hinges to the upper (Q_4) and lower (Q_0) adjacent values. In this study, the box plots of the predicted values from both ANN and multiple regression (MR) models were presented in figure 7.

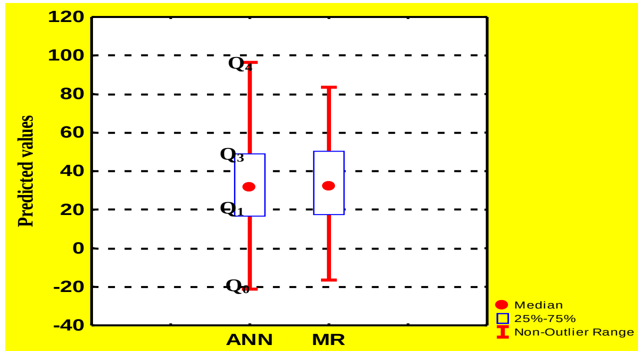


Figure (7): Box plots of the predicted values from ANN and MR models

From this figure, it can be seen that half values of twist loss predicted from the ANN model range between 16.402 and 49.237, whereas the corresponding half values predicted from the MR model varied between 17.228 and 50.567. Also, there is no outliers have been detected from both predicting models. Additionally, the experimental data obtained from both predicting models tend to be symmetrically distributed.

Using box plots, the accuracy and precision of each predictive model can be evaluated. The accuracy is calculated by comparing the Inter Quartile Range (IQR) of the box to its entire domain (equal to Q_4-Q_0). The precision of the model can also be measured by the location of the box in the domain and the position of the median value (Me) in the box itself. It is noteworthy that the box indicates the range in which the fifty percent of the predicted values are contained and it is amounting to 27.9% and 33.3% for the entire domain in the case of predicted values by ANN and MR models respectively. Generally, whenever the ratio is small this means that fifty percent of the predicted values are in a small range around the perfect prediction, which implies that the model accuracy is higher. From the above ratios, it is clear that the ANN model is more accurate than the corresponding MR model.

The median (Me=31.918 and 31.976 for ANN and MR models respectively) of the predicted values is close to the box mean values (equal to 33.772 and 33.533 for ANN and MR models respectively) which means that the average value is located in the range of the box and its very close to the perfect prediction. Strictly speaking, as the box is more centered to the domain, and the value of median is close to the average value, the prediction process by the model is more precise. This means that the ANN and MR predicting models have precision values close to each other.

The closeness of precision values of both predicting models may be due to the high efficiency of both models and the precise measurements during the experimental work.

Finally, the authors recommend performing more studies in relation to twist loss on air-jet weaving machines using AI studies especially machine learning and deep learning, and comparing them with conventional statistical analysis.

Conclusion

During their insertion on Air-Jet weaving machines, the leading end of the filling yarns lose some of their twist values. The loss of twist amount is around 10-15% of the nominal twist. This amount of lost twist will adversely affect the performance of this type of weaving machine, and also deteriorates the physical properties of the produced fabrics. In this work, the key parameters of the Air-Jet Weaving machine, i.e. timing of main nozzle, air pressure of the main nozzle, and machine speed were examined. In addition, the weft yarn counts and their twist multipliers were also investigated. Beside, the distance on the woven fabrics away from the main nozzle was also studied. All the above parameters were related to the amount of twist loss using ANN and regression methodologies. The two predicting techniques were compared, assessed and evaluated using R^2 value, Mean Bias Error (MBE), and Root Mean Square Error (RMSE). It was revealed that ANN technique is outperformed than its counterpart that based on the regression analysis. The predicting power using ANN is more efficient than regression models. .

References

1- O. Taiavasek and V. Svaty. *Shuttleless Weaving Machines*. Elsevier. Amsterdam. p.379, (1981).

2- QinYao-Qi. *The twist loss of the weft during Air-jet weaving*. Letters to the Editor, Journal of the Textile Institute, No.1, , 60-68, (1984).

3- Mansour H. Mohamed, Vienna A. Barghash and Roger L. Barker. *Influence of filling yarn characteristics on the properties of corduroy fabrics woven on air-jet loom*. Textile Research Journal, November, 661-670, (1987).

4- S. A. Mansour, M. A. Saad and Alsiad. Almetwally. *Air – Jet Weft Insertion*, The indian textile journal, December (1997).

5- S. A. Mansour, A. E. Morsy and Alsiad. Almetwally. *Twist loss on Air – Jets: Effects on Various Fabric Properties*. The indian textile journal, PP.12, September (1998).

6- S. A. Mansour, M. A. Saad and Alsiad. Almetwally. *Twist loss on Air – Jets: Effct on Fabric Properties in different Widths*. The Indian textile journal, November (1998).

7- Tejas Parekh, P.P.Raichurkar, L.C.Patil, Rajendra Maid and Tushar Patil. *To analyze the twist loss in weft yarn during Air-Jet weaving and its impact on tensile properties of fabric*. www.fibre2fashion.com, June (2011).

8- Muhammad Umair, Yasir Nawab, Khubab Shaker, Muhammad Maqsood, Adeel Zulfiqar and Danish Mahmood Baitab. *Estimation of twist loss in the weft yarn during Air-Jet weft insertion*. International Journal of Fashion and Textile Engineering Vol.1, No.7, (2014)

9- Muhammad Umair, Khubab Shaker, Yasir Nawab, Abher Rasheed, Sheraz Ahmad. *A study on the twist loss in weft yarn during Air Jet weaving*. Journal of Engineered Fibers and Fabrics, 12(4), 1-6, (2017).

10- Sama Azadi and Ayoub Karimi-Jashni. *Verifying the performance of artificial neural network and multiple linear regression in predicting the mean seasonal municipal solid waste generation rate: A case study of Fars province*, Iran. Waste Management, 48, 14–23, (2016).

11- Alsaid Ahmed Almetwally, Hatim M.F. Idrees and Ali AliHebeish. *Predicting the tensile properties of cotton/ spandex core-spun yarns using artificial neural network and linear regression models*. The journal of the Textile Institute, 105(11), 1221-1229, (2014).

12- Alsaid . A. Almetwally and Mona. M. Salem. *Comparison between Mechanical Properties of Fabrics Woven from Compact and Ring Spun Yarns*. AUTEX Research Journal, 10 (1), March (2010).

13- Yasser. M. Eid, Ahmed Alsalmawy, and Alsaid. A. Almetwally. *Performance of Woven Fabrics Containing Spandex*. Textile Asia, volume XL1 No. 5, PP 39-42, May (2010).

14- Alsaid Ahmed Almetwally and M.M. Mourad .Effects of spandex drawing ratio and weave structure on the physical properties of cotton/spandex woven fabrics. The Journal of the Textile Institute, 105 (3), 235-245, (2014).

15- Alsaid Ahmed Almetwally, M. M. Mourad, Ali Ali Hebeish and Mohamed A. Ramadan. *Comparison Between Physical Properties of Ring-Spun Yarn and Compact Yarns Spun from Different Pneumatic Compacting systems*. Indian Journal of Fibers and Textile Research, 40, 43-50, March (2015).

16- Alsaid Ahmed Almetwally, M. M. Mourad and Ali Ali Hebeish. *Some handle Properties of Cotton fabrics woven from Ring Spun Yarn and Compact Yarns Spun from Different Pneumatic Compacting Systems*. Textile Association journal, 76 (4), 222-228, November-December (2015).

التنبؤ بأداء ماكينة النسيج ذات القذف الهوائى فيما يتعلق بفقد البرمات فى خيط اللحمة باستخدام نماذج الشبكات العصبية الإصطناعية والانحدار الخطى

السعيد أحمد المتولى [١،٢] ، وجدي السيسي[١]
١ كلية تكنولوجيا الصناعة والطاقة، الجامعة التكنولوجية بسمنود ، الغربية ، مصر
٢ معهد بحوث وتكنولوجيا المنسوجات، المركز القومى للبحوث، الدقى ، القاهرة، مصر

الملخص العربي:
أثناء قذف اللحمات على ماكينات النســيج ذات القذف الهوائى، يفقد الطرف المتقدم من خيوط اللحمة جزء من برماتها الأصلية. تتراوح كمية الفقد فى البرمات لهذه الخيوط بين 10% و 15%. تؤثر هذه البرمات المفقودة عكسيا على أداء ماكينات النسـيج ذات القذف الهوائى كما أنها تقلل من الخصـائص الفيزيقية والميكانيكية للأقمشـة المنسـوجة. فى هذا البحث ، تم التنبؤ بكمية البرمات المفقودة فى خيوط اللحمه أثناء عملية القذف على ماكينات النسيج ذات القذف الهوائى بطريقتين وهما الشـبكات العصـبية الاصـطناعية وتحليل الإنحدار. تم اشـتقاق نموذجى التنبؤ بكلا الطريقتين والمقارنة بينهما. كفاءة مقدرة التنبؤ تم أيضـا تقيمها لكلا النموذجين عن طريق معامل التحديد (2R) ، متوســط خطأ التحيز (MBE) والجذر التربيعى لمتوســط الخط (RMSE) . نتائج هذا البحث أوضـحت أن قيم معامل التحديد عالية وقيم باقى المعاملات قليلة لنماذج التنبؤ بواســطة الشــبكات العصــبية الإصــطناعية مقارنة بنماذج الانحدار الخطى. نستخلص من ذلك ان نماذج الشبكات العصبية الإصطناعية أعلى كفاءة ومقدرة فى التنبؤ من نماذج الإنحدار الخطى.

الكلمات المفتاحية: ماكينات النســيج ذات القذف الهوائى ، فقد البرمات ، خيط اللحمة ، خواص القماش ، تحليل الانحدار، الشبكات الاصطناعية العصبية.