BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF TEXTILE AND GINNING ENGINEERING

MODELLING RING SPUN YARN PROPERTIES USING GENERAL REGRESSION NEURAL NETWORK

BY

SSEMAKULA ISAAC

BU/UG/2012/155

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SUPERVISOR: **DR. NIBIKORA ILDEPHONSE**

CO-SUPERVISOR: **MR. SENDAWULA CHARLES**

A FINAL PROJECT SUBMITTED TO THE FACULTY OF ENGINEERING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE TEXTILE ENGINEERING OF BUSITEMA UNIVERSITY

MAY 2016

DECLARATION

I SSEMAKULA ISAAC, declare that this report and everything therein was written by me and me alone.

For this case therefore am held responsible for any mistakes detected in this report though I tried to my level best producing the right one

Therefore I agree that this report has never been published or produced by anybody at any University or any Institution of advanced learning in the whole world.

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SSEMAKULA ISAAC

BU/UG/2012/155

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APPROVAL

This project report has been submitted for examination with approval from the following supervisors:

..... Date .....

DR. NIBIKORA IIDELPHONSE

DEPARTMENT OF TEXTILE AND GINNING

..... Date .....

MR. SSENDAWULA CHARLES

DEPARTMENT OF TEXTILE AND GINNING

ACKNOWLEDGEMENT

I am so much grateful to God for the success of this project, His sufficient grace and provision for its accomplishment.

I extend my sincere gratitude to Dr. Nibikora Iiedelphonse and Mr. Sendawula Charles for serving as my supervisors and for providing encouragement and guidance throughout my work on this paper.

I greatly appreciate my parents, Mr. Ssemakula Charles and Mrs. Nazziwa Susan, my sister and brother who constantly provided me with advice and financial support.

Special thanks to Fine Spinners (U) Ltd (FSL) as well as Mr. Arinaitwe Innocent for the help and guidance towards my research.

Finally, a very special expression of appreciation is extended to friends whose encouragement made this effort possible.

DEDICATION

I dedicate this report to my family which has worked restlessly to push me to this academic height. Especially my beloved dad Mr. SSEMAKULA CHARLES my beloved mum Mrs. NAZZIWA SUSAN SSEMAKULA.

I promise never to forget you, I will always be there for you in any circumstance and I pray hard that you always be around me in any circumstance and to continue rendering me your love and support.

ABSTRACT

Most textile firms use the ring spinning system to spin yarn because it produces strong yarn. However, it is expensive due to extra work and labor e.g. carding, combing, drawing and roving formation.

Also, the machine setting parameters can affect the quality of yarn and therefore there is need to test the yarn quality. Textile firms have therefore used several methods and machines to test for yarn quality e.g. visual examination, cut and weigh methods, gravimetric method, uster technologies etc.

Different instruments have been used e.g. Uster technologies, wrap reel to measure yarn length, Analytical Balance, Knowles Balance and Quadrant Balance to determine yarn count etc. However, these cannot predict yarn properties.

Textile spinning firms are thus faced to deterioration in their research capabilities in the last years due to failure of the present technology in predicting yarn properties, otherwise, they can use try and error method which increases the cost of production if results obtained are poor.

The aim of this work is to model and predict the ring spun yarn properties (strength, evenness and imperfections). Yarn was therefore obtained through a series of experiments carried out at Fine spinners (U) Ltd (FSL) in Kampala – Uganda. Yarn produced was used in developing a General Regression Neural Network (GRNN) to probe the yarn properties of 100% cotton.

This was done by the ring spinning system and the parameters i.e. yarn count, yarn twist and spindle speeds were used as inputs for the GRNN model. The same parameters were used as inputs for the linear regression and the results compared to validate the GRNN model.

According to the results, GRNN had better R^2, RMSE and SSE therefore rendering the GRNN model a success and superior to linear regression models in predicting yarn properties of 100% cotton.

LIST OF FIGURES

CHAPTER ONE:

1.1 BACKGROUND;

Ring spun yarn is produced by the ring spinning process. It is the oldest method. This process is done by the ring spinning frame. The basic purpose of the ring spinning frame is to attenuate the roving until the required fineness of the yarn is achieved.***(Klein, 2001)***

The ring spinning system is widely used and is the most popular form of spinning system. It produces strong yarn and it is expensive due to extra work and Labor e.g. carding, combing, drawing and roving formation.***(T.Rowe, 1994)***

The machine setting parameters can affect the quality of yarn and therefore there is need to test the yarn quality. Textile firms have used several methods and machines to test for yarn quality e.g. visual examination, cut and weigh methods, gravimetric method, uster test etc. ***(Saville, 2000)***

For several reasons, yarn properties have been tested. These include; checking raw materials, monitoring production, assessing final product, investigation of faulty material, and product development and research. ***(Saville, 2000).***

Different instruments have been used e.g. Uster technologies, wrap reel to measure yarn length, Analytical Balance, Knowles Balance and Quadrant Balance to determine yarn count etc. However, these cannot predict yarn properties.

Since the past decade, artificial intelligent methods such as fuzzy logic, neural networks, chaotic theory etc. have emerged rapidly as alternative solutions for system modelling. In particular, neural networks have been widely applied for empirical process modelling, especially for nonlinear or ill- defined processes.***(Teo Lian Seng, 2003).*** Neural networks such as the multi-layer feed-forward networks, recurrent networks etc. can be trained to associate input data to output data.

The models are however not so efficient; therefore this study is to apply General Regression Neural Network (GRNN) ***(Dirk Tomandl, 2001).*** The basic GRRN was published in 1991 by Donald F. Specht ***(Specht 1991)*** and reinvented by Schioler and Hartmann (1992). The GRNN is

REFERENCES:

1. Abhijit Majumdar, P. (2008). Yarn Strength Modelling Using Fuzzy Expert System. *Journal of Engineered Fibers and Fabrics* , 68.

2. Ahmed, O. M. (1996). *Application of General Regression Neural Network (GRNN) in HVAC Process Identification and Control* . Retrieved from Standards Connect The World. We Connect You To Standards.

3. Alilou, V. K. (2015, September 06). *Application of GRNN Neural Network in Non-Texture Image Inpainting and Restoration.* Retrieved from ResearchGate.

4. DF, S. (1991, Febuary 6). *A general regression neural network.* Retrieved from National Center for Biotechnology Information, U.S. National Library of Medicine: A general regression neural network. - PubMed - NCBI.html

5. Dirk Tomandl, A. S. (2001). A Modified General Regression Neural Network (GRNN) with new, efficient traing algorithms as a robust 'black box'- tool for data analysis. *Pergamon* , 1023-1033.

6. Dong, L., & Li, X. (2012, March 1). *An Application of Grey-General Regression Neural Network for Predicting Landslide Deformation of Dahu Mine in China.* Retrieved from Ingentaconnect: An Application of Grey-General Regression Neural Network for Pred... ingentaconnect.html

7. Galili, T. (2013, June 16). *General Regression Neural Network with R. bloggers.* Retrieved from R. bloggers: General Regression Neural Network with R _ R-bloggers.html

8. H. Ghanmi, A. G. (February 2014). Application of artificial neural network in textile: Prediction of ring spun yarn properties. *IOSR Journal of Engineering (IOSRJEN)* , 28.

9. Kamer Kayaer, T. Y. (2015). *Medical Diagnosis on Pima Indian Diabetes.* Istanbul: Yildiz Technical University , Department of Electronics and Comm. Eng.

10. Klein, W. (2001). Textile Institute Short Staple Spinning Series (Volume 1). *Business and Economics* , 10-24.

11. Klein, W. (2012). *Textile Institute Short Staple Spinning Series (Volume 1).*

12. Lu, W., Chu, H., & Zhang, Z. (2015). Application of generalized regression neural network and support vector regression for monthly rainfall forecasting in western Jilin Province, China. *Journal of Water Supply* , 95-104.

13. Nouredine Djarfour, J. F. (2014). Seismic noise filtering based on Generalized Regression Neural Network. *Computers & Geosciences* , 1-9.

14. Saville, B. P. (2000). *Physical Tesing Of Textiles.* Abington, England: WoodHead Publishing Ltd.

15. Shaikh Abdul Hannan, R. R. (2010). Generalized Regression Neural Network and Radial Basis Function for Heart Disease Diagnosis. *International Journal of Computer Applicationc* , 13.

16. Sharif Ahmed, M. S. (2015). Comparative Study on Ring, Rotor and Air-jet spun yarn. *European Scientific Journal January 2015 edition vol.11* , 412- 424.

17. Shuo Ding, X. H. (2013, December). *Scientific.net by Trans Tech Publications Ltd.* Retrieved from Application of General Regression Neural Network in Characteristic Curve Fitting of Optical Fiber Micro-Bend Sensor.: Application of General Regression Neural Network in Characteristic Curve Fitting of Optical Fiber Micro-Bend Sensor.html

18. T.Rowe, K. B. (1994). *Introduction to Textiles (Volume 2).* Guimaraes: Univ.do Minho.

19. Teo Lian Seng, M. K. (2003). Adaptive GRNN modelling of dynamic plants. *Center for Artificial Intelligent and Robotics* (pp. 1-36). kuala Lumpur, Malaysia: Jalan Air Keroh Lama.

20. Walker H. Land, J. T. (2000, February 12). Application of a GRNN oracle to the intelligent combination of several breast cancer benign/malignant predictive paradigms. *Medical imaging 2000 - image processing* . CA, San Diego: SPIE.

21. Xiao-Hong Zhang, Q.-J. W.-J. (2011, December 10). *Application of General Regression Neural Network to the Prediction of LOD Change.* Retrieved from Science Direct.

22. Yan Wang, H. L. (2012, Febuary). *Application of GRNN to Plan Trajectory for a Picking Robot*. Retrieved from Science.Net.

23. Yu, S., Hongzhen, Z., & Yanna, C. (2011, March 28-29). Application of GRNN in Time Series Prediction for Deformation of Surrounding Rocks in Soft Rock Roadway. *IEEE Conference Publications* . Shenzhen, Guangdong: IEE.