

**USING NEURAL NETWORKS FOR
DETECTION OF ANOMALOUS
TRAFFIC IN AUTOMATION
NETWORKS**

Igor Halenár



Universitätsverlag Ilmenau
2012

Impressum

Bibliographic information of the German National Library

The German National Library lists this publication in the German national bibliography, with detailed bibliographic information on the Internet at <http://dnb.d-nb.de>.

Author's acknowledgement to Gabriela Chmelíková for translation.

This scientific monograph originated from the author's dissertation thesis defended at the Slovak University of Technology in Bratislava, Faculty of Materials Science and Technology in Trnava.

Reviewers:

Prof. Dr.-Ing. habil. Peter Husar
Prof. Ing. Juraj Spalek, PhD.
Ing. Augustín Gese, CSc.

Author's contact address:

Ing. Igor Halenár, PhD.
Slovak University of Technology in Bratislava
Faculty of Materials Science and Technology in Trnava

Ilmenau Technical University / University Library

Universitätsverlag Ilmenau

Postfach 10 05 65
98684 Ilmenau
www.tu-ilmenau.de/universitaetsverlag

Production and delivery

Verlagshaus Monsenstein und Vannerdat OHG
Am Hawerkamp 31
48155 Münster
www.mv-verlag.de

ISSN 2193-6439 (Print)
ISBN 978-3-86360-049-5 (Print)
URN urn:nbn:de:gbv:ilm1-2012100213

Titelfoto: photocase.com

Scientific Monographs in Automation and Computer Science

Edited by
Prof. Dr. Peter Husar (Ilmenau University of Technology) and
Dr. Kvetoslava Resetova (Slovak University of Technology in
Bratislava)

Vol. 7

CONTENTS

INTRODUCTION.....	8
1. DATA TRANSFER IN NUMERIC SYSTEMS CONTROL	10
1.1 Communication standards of control and production systems.....	10
1.1.1 Automation networks protocols encapsulation.....	11
1.2 Reference structure model of communication protocols.....	15
1.3 Protocols of RM OSI 3rd and 4th layers.....	18
2. SECURITY OF CONTROL SYSTEMS IN DATA TRANSFER..	20
2.1 Categories of communication systems attacks.....	21
2.1.1 Special techniques of data transfer.....	23
2.2 Ways of industrial systems security.....	25
2.2.1 Firewall.....	26
2.2.2 IDS.....	27
3. ANALYSIS OF CURRENT NEURAL NETWORKS TECHNOLOGIES.....	28
3.1 Neural structure.....	29
3.1.1 Topology of neural networks.....	33
4. SUBJECT MATTER FORMULATION	35
5. POSSIBILITIES OF NN USE BY SYSTEMS COMMUNICATION VALIDATION.....	38
5.1 System proposal.....	40
5.2 Proposal of host system.....	41
5.2.1 Determination of parameters for transfer anomalies detection.....	47
5.3 Selection of neural network algorithm.....	48
5.4 Implementation proposal and learning of network.....	51
5.4.1 Application equipment for neural networks implementation.....	52
5.4.2 Preparation of input data.....	55
5.4.3 Neural network implementation.....	64
5.5 Experimental system verification.....	70
5.5.1 Testing of proposed neural network.....	70
5.5.2 Possibilities of practical implementation.....	73
6. CONCLUSION	75
6.1 Possibilities of further development.....	78
REFERENCES	80