



## REVIEW

by Professor Dr. Eng. Rosen St.Iliev,  
Defence Institute "Professor Tsvetan Lazarov"

**for the dissertation of Tihomir Videv Videv**

**on GENERALIZED NET MODELS OF DATA MINING PROCESSES  
FOR MANAGEMENT AND PROTECTION OF SMART HOME**

for awarding the educational and scientific degree "DOCTOR"  
in the doctoral program "Computer Systems and Technologies"  
in area 5. "Technical Sciences",  
professional field 5.3. "Communication and Computer Engineering"

## **1. Relevance and significance of the developed scientific problem**

With the development of information and communication technologies and the advent of artificial intelligence in recent years, have led to the creation of many smart household devices that are already part of our daily lives. Concepts such as “Smart Home”, “Smart City”, etc., are the result of this modern technological revolution, one of the manifestations of which is the Internet of Things (IoT). That is why Tihomir Videv's dissertation examines this very important topic, namely – the creation of generalized net models of Data Mining processes for managing and protecting a smart home.

There is no doubt in the relevance and the significance of the scientific problem developed by the author, for which adequate models are offered by applying the theories of generalized nets and intuitionistic fuzzy sets, created by the great Bulgarian scientist of international fame – academician Krasimir Atanassov.

## **2. General characteristics and structure of the dissertation work**

The dissertation is structured into an introduction, three chapters with implications, conclusion, contributions, directions for future research, publications on the dissertation, statement of originality, bibliography and appendix, with a total volume of 112 pages.

The formulated goal of the dissertation work resonates with the topic of the dissertation and the 7 main tasks set for research correspond to the scientific problem under consideration and are sufficient for its investigation.

*In the First chapter*, basic concepts from the theory of generalized nets are examined, the formal descriptions and definitions are presented, the algorithms for the functioning of the transitions, the categories of operators used, various types of generalized nets and the ways of their construction are described. Attention is paid to the essence of the process of extracting knowledge (Data Mining) aimed at the investigated problem area and the work tools and techniques used are described. Implications are given at the end of the chapter.

*In the Second chapter*, generalized net models of systems for Data Mining processes in a smart home are proposed. After a detailed description of the essence and functioning of the smart home based on the use of the modern technological direction “Internet of Things”, the author examines several original generalized net models – for a network for automatical turning on and adjusting the lighting in a room, for automated lighting system in a room using simulation through the GN IDE software environment, as well as an intuitionistic fuzzy estimation (IFE) GN-model of a smart home cyber system. An alternative method for evaluating the cyberattack of smart home management through intuitionistic fuzzy evaluation is

also presented, as well as a GN-model for evaluating the possibility of penetrating Smart Home systems through IFE. Finally, the chapter ends with an implication.

In the third chapter, generalized net models of Data Mining processes related to the security of a smart home, of the states of a real payment process in PGW and of a standard Internet portal for electronic payment are developed, using intuitionistic fuzzy estimations for this purpose. At the end of the chapter, a GN-model for cyber-interference risk assessment on drone control using intuitionistic fuzzy estimation and a GN-model of a “Smart Home” power and security system are presented. The chapter ends with implications.

In the conclusion, a brief review of the research done in the dissertation work and its possible application is made.

The results obtained by the author are reflected in the mentioned contributions to the dissertation work.

The given directions for future research indicate the ideas that emerged as a result of the development of the dissertation, which are of interest for future development.

### **3. Evaluation of the scientific results and contributions of the dissertation work**

Tihomir Videv's dissertation work has been developed in the necessary volume and completeness and is in accordance with the topic, the formulated goal and the set research tasks. The created generalized net models are original and show a good understanding of the scientific problem and the proposed toolkit for its solution. The formulated contributions of the scientific work are a logical consequence of the scientific and applied research presented in the main part of the dissertation.

I accept the results defined by the author as development and enrichment of existing knowledge and application of scientific achievements to solve important practical tasks.

I believe that the dissertation work and the results obtained in it are credible and are a consequence of the scientific research, studies and analyses, as well as the experiments conducted with the models developed for the purpose.

### **4. Evaluation of dissertation publications and authorship**

In the attached list of publications related to the dissertation, there are eight titles that present the research results to the scientific community. The publications are co-authored, with Mr. Videv being the first author of three of them. Six of the publications are presented in world-renowned databases, with 3 of them in Springer issues and one in an IEEE conference.

The publications present the main part of the author's research and the results achieved by him.

### **5. Opinion on the presence or absence of plagiarism**

I have not noticed any plagiarism in the author's work. The nature of the content and the uniform style of presentation are proof, in my opinion, of the doctoral student's indisputable personal involvement in the contributing part of the dissertation work.

### **6. Literary awareness and competence**

In his work on the dissertation, the author used 112 literary sources, of which 106 are in Latin (English) and 6 are in Cyrillic (Bulgarian and Russian). Most of the cited sources (68 in number) are from the last 10 years, and some of the publications are fundamental, such as those on General Nets Theory and Intuitionistic Fuzzy Set Theory.

The indicated literary sources are reflected in the main text of the dissertation work and are appropriately used by the author in his work.

### **7. Evaluation of the abstract**

The presented abstract consists of 51 pages and was developed in accordance with the dissertation work, presenting adequately and in the necessary volume the results achieved by the author during the research.

### **8. Critical notes and recommendations**

I have no significant critical comments on the dissertation and the abstract. However, it struck me that in the GN-model presented in item 2.2.1, the same symbol  $\mu$  is used for fuzzy estimation (on page 59) and as a token in the net (on page 61). In Figure 2.13, there is an unnecessary double crossing of lines from position  $L_{14}$  to transition  $Z_5$ , which does not, however, change the correct operation of the net. The implications to the individual chapters summarize well the results achieved, but could be shorter.

The indicated critical remarks are not essential and do not affect in the least my good impression of the author's work, as well as my overall assessment of the results achieved in the dissertation work.

I recommend the author to continue his further work in this interesting area



of research and to implement the directions set in his dissertation for future research by developing them into concrete practical applications.

### **9. Personal impressions**

I do not know Mr. Videv personally, but from the attached reference and materials it can be seen that he has the necessary education and competence in the field of computer technologies and systems and has the necessary experience to apply the obtained scientific results in practice. I am pleasantly surprised by the very good knowledge of the subject of research, especially in terms of technological solutions for building smart homes and the possibilities for their cyber protection.

I have no joint posts with the candidate.

### **10. Conclusion**

In consequence of the above, I define Mr. Videv's dissertation work as a completed scientific study, which in terms of content, volume and structure fully meets the requirements provided in the Law for the Development of the Academic Staff of the Republic of Bulgaria (LDASRB) and its regulations for awarding the educational and scientific degree "doctor".

### **11. Evaluation of the dissertation work**

The content of the dissertation, the abstract, the fulfillment of the procedural requirements for compliance with the LDASRB and the regulations to it, as well as my personal impressions, provides me the reason to give a POSITIVE ASSESSMENT of the dissertation work "Generalized net models of Data Mining processes for management and protection of intelligent home" and I propose the author, Tihomir Videv Videv, to be awarded the educational and scientific degree "Doctor", in the field of higher education 5 "Technical sciences", professional direction 5.3 "Communication and computer technology".

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Reviewer:...

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(Prof. Dr. Rosen Iliev)