

INFORMATICS

Detection of vulnerabilities in web applications

supervisor: doc. RNDr. Jozef Jirásek, PhD.

study form: full time

Annotation: Most of the currently used web applications has hidden weaknesses in implementation which could be misused by unauthorized persons using known methods (e.g. Structured Query Language (SQL) Injection, Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF)). Web application developers usually realize the existence of weaknesses only when there is an attack or a manipulation with the code by another person. Since the Web applications contains thousands lines of code, it is rather complicated to find vulnerabilities inside. However, the abusing of vulnerabilities can be avoided by monitoring the behavior of attackers during the attack. The aim of the thesis is to analyze the approaches to the problem and propose a model of vector and graph attacks against Web applications depending on a pre-defined purpose of web applications.

Detection of multistage network attacks

supervisor: doc. RNDr. Jozef Jirásek, PhD.

study form: full time

Annotation: With the growing amount and kinds of network intrusions, multi-stage attacks are becoming the one of the main methods of the network security threaten. The process of multi-stage attack is composed of a number of interrelated attack steps, the previous one being the occurring condition of the latter one which made it more difficult to detect by current security tools. The aim of this thesis is to analyze existing solutions, compare them with regard to their effectiveness, the occurrence of false positive alarms and applicability in a real network environment. At the same time the aim is to develop new models of protection against these types of attacks.

Plasticity and attention in spatial hearing

supervisor: doc. Ing. Norbert Kopčo, PhD.

study form: full time

Annotation: In everyday situations, humans are exposed to multiple concurrent stimuli in complex, continuously changing environments. To correctly extract relevant information, they adapt their processing to reflect the specifics of the current scene, and they learn from previous experience to improve the perceptual strategies used. The current project proposes to perform a series of behavioral experiments, brain imaging studies, and computational modeling to study how attention and mechanisms of implicit and explicit learning are used to cope with complex listening environments for speech processing, sound localization, and learning of new phonetic categories.

Cross-modal interactions and spatial auditory processing

supervisor: doc. Ing. Norbert Kopčo, PhD.

study form: full time

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Brain-training games for spatial hearing

supervisor: doc. Ing. Norbert Kopčo, PhD.

study form: full time

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Natural language processing

supervisor: doc. RNDr. Stanislav Krajči, PhD.

study form: full time

Annotation: It is necessary to understand the structure of a grammatical sentence to work satisfactory with a natural language. The syntactical analysis of a sentence is a problem where computer science methods can be applied effectively. Our database of almost all Slovak word forms would be very helpful in this process.

Heterogeneous concept lattices

supervisor: doc. RNDr. Stanislav Krajči, PhD.

study form: full time/external

Annotation: Formal concept analysis is a data-mining method applied to a rectangular matrix of data in which each row corresponds to some object, each column corresponds to some possible attribute, and the matrix field value denotes a membership of the column attribute for row object. One of the goals of this method is to find so-called concepts, which are stable (in some sense) pairs of subsets of objects and attributes. The method can be considered a nice application of the algebraic notion of a Galois connection. It has been described in detail by Ganter and Wille, in particular for the so-called crisp case with binary matrix data. A natural question that arises is what happens if the matrix data are non-binary...

Community detection in social networks

supervisor: doc. RNDr. Gabriel Semanišin, PhD.

study form: full time

Annotation: Social networks provide new phenomenon in a communication and information exchange. They combine features of standard communication networks with effects know from some areas of biology and medicine. Social networks can be modelled by graph-theoretical concepts. These models allow studying conditions that determine the intensity of information spreading.

Graph theoretical and algorithmic aspects of communication networks

supervisor: doc. RNDr. Gabriel Semanišin, PhD.

study form: full time

Annotation: The development of Internet of Things requires solutions for various aspects of a communication in computer and sensor networks. These networks can be modelled by graph-theoretical concepts. Such models provide bases for a formulation and solution of algorithmic problems that are related to network creation, data transfer and securing. These topics are studied very extensively and relatively big number of recent papers with significant theoretical and practical impact was published recently.

Modeling and algorithms for construction of smooth curves

supervisor: doc. RNDr. Csaba Török, CSc.

study form: full time

Annotation: Recently we proposed a new approach to solving the tridiagonal systems on a uniform grid of nodes. One of the goals of the thesis is to investigate the effect of the given approach on the nonuniform grid and the inversion of tridiagonal matrices. Classic cubic splines of class C^2 are implicit. We succeeded to express them in an explicit form that enables a design of a linear model for approximation and estimate of spline coefficients. The second goal is to analyze the properties of LS estimate of coefficients and their comparison with B-splines. The third goal is finding of criterion of optimal stopping in on-line approximation according to prediction in an appropriate metric.