List of Dissertation Abstract (Department of Information Environment)

Name	Supervisor	Title	Abstract
Hasanvand Morteza	Kenta Ozeki	Coloring of planar graphs and its relations to hypergraph coloring	In this thesis, we investigate coloring of planar graphs and complete colroing of hypergraphs and use the idea of complete facial coloring of planar graphs for the second purpose. More precisely, we first show that every planar graph with maximum degree at most Δ has the 3-distance chromatic number at most $(6+o(1))\Delta$. In addition, we show that every subcubic planar graph has the 3-distance chromatic number at most 17 and conjecture that this number can be improved to 12. In the next step, we show the interpolation property of complete colroing fails for all uniform hypergraphs; in particular, 3-uniform hypergraphs. In our construction, planar triangulations play an important role. As a consequence, we solve several open problems in this concept.
MURAKAMI SATOSHI	TOMOHARU NAGAO	A Study on Information Extraction from Manga Images and Its Applications	This study applies CNN-based classification and detection to comic images, which contain a complex mixture of images and text. First, we describe a super-resolution enlargement system using a CNN that can enlarge all style of page images in an e-book while simultaneously reducing image compression noise. Next, a system was built to detect inappropriate objects (limited to exposed breasts) within each frame extracted by a frame extractor, a new method capable of extracting frames within a page using CNN with accurate geometry, and the results were shown in operation at an e-book production site.

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Arai Yu	Tsutomu Matsumoto	Research on the Appropriate Use of Machine Learning in Cyber Security Domain	Developments in machine learning have advanced everyday technologies such as smartphones, and their applications are wide-ranging. In cybersecurity, however, the use of this technology has been limited to complementing existing methods. This study explores the potential for more active use of machine learning in cybersecurity and proposes an automatic detection system for crime-related sites on the Dark Web. We also identify shortcomings of machine learning in existing antivirus products and develop workarounds. This will enable further appropriate use of machine learning.
Kuzuya Naoki	Tomoharu Nagao	A Study on Neural Networks for Fast Inference in Embedded Systems Using B-spline Functions	In this research, we propose a method for constructing an efficient neural network that replaces the conventional neural network’s computation nodes with more efficient ones in terms of accuracy and execution time on the embedded CPUs.

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Oyu Kodai	Atsushi Noma	The maximal ideal cycles and the fundamental cycles for normal surface singularities branched over analytically irreducible singular plane curves	In the study of normal surface singularities, the problem of comparing maximal ideal cycles with fundamental cycles is an important topic. This paper investigates whether the two cycles coincide on the minimal resolution of a normal surface singularity defined by z^n=f(x, y) with irreducible f(x, y). As a result, we proved that the two cycles coincide when n=3, and we also calculated the fundamental genera. Furthermore, we showed several examples where the two cycles do not coincide when n = 4 or more.
Nakano Hiroki	Tsutomu Matsumoto	A Study on Impact of User-generated Content on Cybersecurity	The development of the Internet has led to the proliferation of user-generated content (UGC) and the diversification of information sharing, as well as cybersecurity issues. This paper investigates the impact of UGC on cybersecurity and clarifies its impact on vulnerabilities of Android applications, the reality of attacks across multiple platforms, and the effectiveness of shared threat information. These results indicate that proper management of UGC by platform operators and appropriate discarding of information by users themselves are extremely important.

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Hamano Ryoki	Shinichi Shirakawa	A Study on Evolutionary Computation for Mixed-Integer and Mixed-Category Black-Box Optimization	This study targets mixed-integer black-box optimization and mixed-category black-box optimization problems and develops evolutionary computation methods for these simultaneous optimization problems. The Covariance Matrix Adaptation Evolution Strategy (CMA-ES) is one of the most promising evolutionary computation methods, but it can only handle continuous variables. This study establishes a simultaneous optimization method by improving CMA-ES to a method that can also handle discrete variables.
Gay Camille	Tsutomu Matsumoto	Controller Area Network Message Timestamp Analysis and its Applications for Automotive Security Technologies	Automotive systems, typically consisting of a network of Electronic Control Units (ECUs) connected with the Controller Area Network (CAN) protocol, are increasingly exposed to cyber-attacks. Malware targeting ECUs may become widespread in the future. We identified flaws in previously proposed security technologies and proposed various improvements and alternatives. We explored the methods that malware can employ to detect that it is being executed in an ECU network simulation instead of a real vehicle, and developed an environment that can reproduce CAN traffic with the same properties as a real vehicle. It could be used as a malware analysis platform or as a testbed to evaluate ECU technologies.