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Master Thesis

in

Automatic Control and Robotics

of

The Department of Robotics and Decision Systems

2021/2022

All the diploma projects given in the Polish version can be performed and edited in English. **Below you can find few samples of MSC Thesis in English**

Ms thesis title (Polish)	Konstrukcja robota mobilnego reagującego na komendy głosowe
Ms thesis title (English)	Construction of voice controlled mobile robot.
Project supervisor	prof. dr hab. inż. Zdzisław Kowalczyk
Project consultant	mgr inż. Robert Drozd
Project goal	The goal of this thesis is to design and construct a mobile robot that will react to user's voice commands.
Tasks	1. Construction of a mobile robot. 2. Design of voice recognition system. 3. System tests.
Bibliography	1. Sali, Sharanbasappa & Mahindrakar, Nagesh & Mule, Santosh & Naik, Somaling. (2016). Voice Activated Multipurpose Robot. International Journal of Advancement of Engineering & Technology, Management & Applied Science. 3. 283-291.
Number of authors	1
Comments	ZFK1

Temat w języku polskim	Wykrywanie anomalii w różnych rodzajach danych z użyciem sieci neuronowych
Temat w języku ang.	Anomaly detection in various typed of data using neural networks
Opiekun pracy	prof.. Z. Kowalczyk
Konsultant pracy	mgr inż. Karol Szymański
Cel pracy	The aim of the work is to create systems capable of detecting anomalies in data sets with images, sounds and time sequences
Zadania do wykonania	1. Literature review 2. Selection of specific applications for each data domain 3. Data collection 4. System implementation 5. System tests
Źródła	1. Deep Learning for Anomaly Detection: A Review - G.Pang, C.She, L. Cao, A. Hengel, ACM Comput. Surv., 2020 2. Deep learning for anomaly detection: A survey R Chalapathy, S Chawla - arXiv preprint arXiv:1901.03407, 2019 3. Anomaly detection using one-class neural networks, R Chalapathy, AK Menon, S Chawla - arXiv preprint arXiv:1802.06360, 2018
Liczba wykonawców	1
Uwagi	ZFK2

Ms thesis title (Polish)	Modelowanie i symulacja przepływu w systemach rurociągowych z rozgałęzieniami
Ms thesis title (English)	Modeling and simulation of branched pipeline systems
Project supervisor	prof. dr hab. inż. Zdzisław Kowalczyk
Project consultant	dr inż. Marek S. Tatar
Project goal	The goal of the project is to review literature and on its basis develop a model useful in branched pipeline systems. The model should take into account local models of a T-connector with both balanced and not inlet-outlet mass-flow rates. The developed model should be validated in simulation, preferably supported by experimental data
Tasks	<ol style="list-style-type: none"> 1. Literature review 2. Formulation of assumptions 3. Model development 4. Simulation tests and validation 5. Conclusions
Bibliography	<ol style="list-style-type: none"> 1. Bahadori A.: "Oil and Gas Pipelines and Piping Systems", Springer, 2016 2. Coulbeck B., Evans E.P.: "Pipeline Systems", Springer, 1992
Number of authors	1
Comments	ZFK3

Ms Thesis Title (Polish)	Analogowy zestaw edukacyjny do modelowania i estymacji parametrycznej obiektów w układach automatyki
Ms Thesis Title (English)	An analog educational set for modelling and parameter estimation of plants in automation systems
Project supervisor	J. Kozłowski, PhD
Project consultant	J. Kozłowski, PhD
Project goal	Student has to increase his knowledge on modelling of continuous systems (i.e. differential equations, state-space models, etc.) and proper estimation schemes. Hardware part with analog devices (e.g. DC engines) has to be assembled. Yet, on-line presentation (PC screen) of estimation results has to be available in the ultimate set.
Tasks	<ol style="list-style-type: none"> 1. Get familiar with the literature on modelling of non-trivial continuous-time automation systems. 2. Implement and verify numerically the selected estimation procedures. 3. Design and implement hardware part of the educational set.
Bibliography	<ol style="list-style-type: none"> 1. Ljung L.: System identification. Theory for the user. Prentice-Hall Inc., Englewood Cliffs, New Jersey, USA, 1987 2. Unbehauen H., Rao G.P.: Continuous-time approaches to system identification - a survey. Automatica, vol. 26, 1990
Number of authors	1 person
Comments	JK1a

Ms thesis title (Polish)	Wielokryterialna genetyczna optymalizacja zadań pakowania
Ms thesis title (English)	Multi-objective genetic optimization of rectangular packing problem
Project supervisor	dr inż. Tomasz Białaszewski
Project consultant	
Project goal	The aim of the work is to develop methods of multi-objective genetic optimization for solving of packing problem
Tasks	<ol style="list-style-type: none"> 1. carrying out appropriate search for bibliographic 2. development and implementation of multi-objective genetic algorithms 3. carrying out appropriate simulation experiments 4. development of numerical results 5. presentation of conclusions (advantages, limitations of the method / program development directions of the program)
Bibliography	<p>[1] Coello C.C.A., Lamont G.B., Van Veldhuizen D.A., 2007. Evolutionary algorithms for solving multi-objective problems, <i>Genetic and Evolutionary Comutation</i>, (2nd edition). Springer, Berlin.</p> <p>[2] Michalewicz Z., Fogel D. B.: How to solve it: Modern Heuristics. 2nd edition, Springer-Verlag, Berlin 2004.</p>
Number of authors	1
Comments	TB1a

Ms thesis title (Polish)	Wielokryterialne strategie zespołowe w optymalizacji trajektorii ramienia robota
Ms thesis title (English)	Multi-objective teams strategies optimization of trajectory of a robot arm
Project supervisor	dr inż. Tomasz Białaszewski
Project consultant	
Project goal	The aim of the work is to develop methods of multi-objective teams staregies optimization for searching optimal trajectory of a robot arm
Tasks	<ol style="list-style-type: none"> 1. carrying out appropriate search for bibliographic 2. development and implementation of multi-objective teams strategies algorithms 3. carrying out appropriate simulation experiments 4. development of numerical results 5. presentation of conclusions (advantages, limitations of the method / program development directions of the program)
Bibliography	<p>[1] Coello C.C.A., Lamont G.B., Van Veldhuizen D.A., 2007. Evolutionary algorithms for solving multi-objective problems, <i>Genetic and Evolutionary Comutation</i>, (2nd edition). Springer, Berlin.</p> <p>[2] Michalewicz Z., Fogel D. B.: How to solve it: Modern Heuristics. 2nd edition, Springer-Verlag, Berlin 2004.</p>
Number of authors	1
Comments	TB1b

Ms thesis title (Polish)	Symulacja propagacji fal elektromagnetycznych w ośrodkach opisanych modelami niecałkowitego rzędu
Ms thesis title (English)	Simulation of propagation of electromagnetic waves in media described by fractional-order models
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	
Project goal	The aim of the work is to develop an electromagnetic simulator that will enable the simulation of the propagation of electromagnetic waves in media of fractional order. The simulator should be based on the finite-difference method in the time domain and allow simulations of electromagnetic wave scattering.
Tasks	<ol style="list-style-type: none"> 1. Literature review. 2. Development of the fractional order model for the dielectric. 3. Numerical implementation. 4. Scattering simulations.
Bibliography	<ol style="list-style-type: none"> 1. S. Westerlund and L. Ekstam, "Capacitor theory," in IEEE Trans DEI, vol. 1, no. 5, pp. 826-839, 1994. 2. Mescia, L., Bia, P. and Caratelli, D. (2019), Fractional-Calculus-Based Electromagnetic Tool to Study Pulse Propagation in Arbitrary Dispersive Dielectrics. Phys. Status Solidi A, 216: 1800557.
Number of authors	1
Comments	TS1a: Reservation: Piotr Pietruszka

Temat w języku polskim	Opracowanie efektywnej metody reidentyfikacji obiektów w systemie wizyjnym
Temat w języku ang.	Development of efficient object re-identification in computer vision system.
Opiekun pracy	dr hab. inż. Tomasz Stefański
Konsultant pracy	mgr inż. Łukasz Grzymkowski
Project goal	Reidentification determines whether the object that is observed by the system is new or already seen, known and described. The aim of the work is to build a vision system that will effectively re-identify objects based on changing data (different sources, arrangements, etc.).
Tasks	<ol style="list-style-type: none"> 1. Examination of methods of creating representations of objects based on a vision system. 2. Designing the object re-identification system 3. Research on the developed algorithms.
Bibliography	<ol style="list-style-type: none"> 1. „Viewpoint-Aware Loss with Angular Regularization for Person Re-Identification”, Zhu Zhihui, et al., April 2020 Proceedings of the AAAI Conference 34(07):13114-13121. 2. „Spatial-Temporal Graph Convolutional Network for Video-Based Person Re-Identification”, Jinrui Yang, et al., Proceedings of the IEEE/CVF Conference, 2020, 3289-3299.
Number of authors	1
Comments	TS2a:

Ms thesis title (Polish)	Wykorzystanie metod sztucznej inteligencji do rozpoznawania rodzaju ludzkiej aktywności
Ms thesis title (English)	Human activity classification using artificial intelligence
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	mgr inż. Łukasz Grzymkowski
Project goal	The aim of the work is to design and create a system for the analysis and classification of human activity. For example, the system analyzes the video stream with deep learning models to detect human body poses and classifies people's activity in real time. The system should classify selected, basic human activities, e.g. walking, running, interaction with objects.
Tasks	<ol style="list-style-type: none"> 1. Examine the models and algorithms of behavior analysis. 2. Designing a method of classification of human activity. 3. Collecting the results of experimental system operation.
Bibliography	<ol style="list-style-type: none"> 1. „Distribution-Aware Coordinate Representation for Human Pose Estimation”, Feng Zhang, et. al.; Proceedings of the IEEE/CVF Conference, 2020, pp. 7093-7102. 2. „LiftFormer: 3D Human Pose Estimation using attention models”, Adrian Llopart, arxiv.org/abs/2009.00348
Number of authors	1
Comments	TS3a:

Ms thesis title (Polish)	Porównanie wpływu kwantyzacji na różne zadania z zakresu wizji komputerowej
Ms thesis title (English)	Comparing impact of quantization on various computer vision tasks
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	mgr inż. Piotr Kopa Ostrowski
Project goal	The aim of the work is to investigate the influence of quantization on the operation of the neural network model depending on the problem being solved. The tasks to be compared should include both segmentation and selected problems in the field of quality improvement (e.g. denoise or increasing resolution).
Tasks	<ol style="list-style-type: none"> 1. Training neural network models for various tasks in the field of computer vision. 2. Quantization of models or training of models using the Quantization Aware Training method. 3. Comparing the results
Bibliography	<ol style="list-style-type: none"> 1. Esser, Steven K., et al. "Learned step size quantization." arXiv preprint arXiv:1902.08153 (2019). 2. Yoojin Choi, Mostafa El-Khamy, and Jungwon Lee. Learning low precision deep neural networks through regularization. arXiv preprint arXiv:1809.00095, 2, 2018.
Number of authors	1
Comments	TS4a:

Ms thesis title (Polish)	Redukcja kanałów modeli służących do segmentacji obrazu wideo dla przyspieszenia inferencji i redukcji rozmiaru modelu
Ms thesis title (English)	Channel pruning of video segmentation models for fast inference and size reduction
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	mgr inż. Piotr Kopa Ostrowski
Project goal	The aim of the work is to develop an algorithm for channel reduction in convolutional layers of neural networks. Channel reduction can reduce both the prediction time and the size of the model. To test it, video segmentation architectures are used.
Tasks	1. Literature review 2. Training neural network models. 3. Analyzing impact of channel pruning on segmentation quality
Bibliography	1. Wei-Ting Wang, Han-Lin Li, et al. Architecture-aware network pruning for vision quality applications. In 2019 IEEE International Conference on Image Processing (ICIP), pp.2701–2705. IEEE, 2019. 2. Fuxun Yu, Zirui Xu, et al. Towards latency-aware dnn optimization with gpu runtime analysis and tail effect elimination. arXiv preprint arXiv:2011.03897, 2020.
Number of authors	1
Comments	TS5a:

Ms thesis title (Polish)	Synchronizacja nagrań video z układów z dwiema kamerami
Ms thesis title (English)	Synchronization of videos recorded by dual-camera setup
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	mgr inż. Dharm Skandh Jain
Project goal	The aim of the project is to develop an efficient algorithm for the exact synchronization of video materials of the same scene, captured by two different cameras. Synchronization can be performed on the basis of movements observed in the video or other detected features.
Tasks	1. Estimating motion parameters based on video image. 2. Timing of video sequences based on motion parameters. 3. Code optimization and result verification. 4. Graphical representation of the results.
Bibliography	1. Zhang, Tong, and Carlo Tomasi. "Fast, robust, and consistent camera motion estimation." Proceedings. 1999 IEEE Computer Society Conference on Computer Vision, 1999. 2. Coakley, Kevin J., and Paul Hale. "Alignment of noisy signals." IEEE Trans. IM 50.1 (2001): 141-149.
Number of authors	1
Comments	TS6a:

Ms thesis title (Polish)	Wyrównywanie jasności w zdjęciach panoramicznych z wykorzystaniem sieci neuronowych
Ms thesis title (English)	Deep gain compensation for image panoramas
Project supervisor	dr hab. inż. Tomasz Stefański
Project consultant	mgr inż. Dharm Skandh Jain
Project goal	The aim of the project is to develop a solution that allows the brightness to be equalized in panoramic photos. A solution using neural networks enabling local gain compensation should be developed. This is a task similar to creating a mosaic from a video or a two-dimensional SLAM problem with correcting sudden changes in brightness between mosaic elements.
Tasks	<ol style="list-style-type: none"> 1. Detection of edges requiring correction. 2. Development of a deep model of gain compensation. 3. Combining the photo pyramid and comparizons. 4. Visual representation of the results.
Bibliography	<ol style="list-style-type: none"> 1. Brown, Matthew, and David G. Lowe. "Automatic panoramic image stitching using invariant features." IJCM 74.1 (2007): 2. Brzeszcz, Mateusz, and Toby P. Breckon. "Real-time construction and visualisation of drift-free video mosaics from unconstrained camera motion." The Journal of Eng. 2015
Number of authors	1
Comments	TS7a:

Ms thesis title (Polish)	Algorytmy wizualnej odometrii wyznaczające trajektorię poruszającego się obiektu
Ms thesis title (English)	Visual odometry algorithms determining the trajectory of a moving object
Project supervisor	dr inż. Mariusz Domżański
Project consultant	
Project goal	The goal of the project is to conduct a literature review, select and implement few visual odometry algorithms, and to perform trajectory estimation based on a video sequence recorded in a moving object. The study should include the analysis of the results and the comparison with the algorithms based on the GPS system.
Tasks	<ol style="list-style-type: none"> 1. Literature review. 2. Implementation of the selected algorithms 3. Analysis of the results and conclusions
Bibliography	<ol style="list-style-type: none"> 1. Estimation and Prediction of the Vehicle's Motion Based on Visual Odometry and Kalman Filter, Musleh et al. ACIVS 2012: Advanced Concepts for Intelligent Vision Systems pp 491-502 2. Internet
Number of authors	1
Comments	MD1a: