FACULTY
OF INFORMATION
TECHNOLOGY
CTU IN PRAGUE

ASSIGNMENT OF BACHELOR'S THESIS

Title:	Pedestrian reidentification in camera system
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Supervisor:	Ing. Filip Naiser
Study Programme:	Informatics
Study Branch:	Computer Science
Department:	Department of Theoretical Computer Science
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Instructions

Managers of complex buildings (like shopping malls, office space) are dealing with various tasks (e.g., minimization of wait time, queue prevention, advertisement placement).

The pedestrian detection system, gender and age prediction, and inter-camera identity preservation are crucial in order to know the customer. In
iC Systems.ai, s.r.o. we are developing such systems.

A student is going to deal with identity perseverance among multiple cameras. At first, he performs a literature review on this topic. Then, he will design a solution for cameras with and without a field of view intersection. Next, the student will design and train a neural network. This network will encode the given image crop into a descriptor vector. The student will use this vector for measuring similarity between pedestrian image crops. He will also design inter-camera identity matching. This matching process will take into account locational and time consistency.

References

Will be provided by the supervisor.

doc. Ing. Jan Janoušek, Ph.D.
Head of Department

doc. RNDr. Ing. Marcel Jiřina, Ph.D.
Dean

Prague February 24, 2020

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Bachelor's thesis

Pedestrian reidentification in a camera system

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Department of theoretical computer science
Supervisor: Ing. Filip Naiser

August 25, 2020

Acknowledgements

[[Write acknowledgements]]

Declaration

I hereby declare that the presented thesis is my own work and that I have cited all sources of information in accordance with the Guideline for adhering to ethical principles when elaborating an academic final thesis.

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In Prague on August 25, 2020 . . . . . .

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Faculty of Information Technology
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Abstrakt

Sledování pohybu předmětů a těžba dat z kamerového obrazu je zajímavá oblast výzkumu s širokou aplikací. V našem případě je cílem sběr statistik o průchodech lidí komplexními budovami, jako jsou například obchodní centa. Získaná data jsou velmi cenná, jelikož jimi můžeme mimo jiné předpovídat fronty, plánovat využití místností, nebo zkvalitňovat služby. Takový prostor je ovšem rozlehlý a členitý, proto musíme vyvynout síť kamer, která bude monitorovat všechna kritická místa. V této práci představujeme způsob, jakým nezávislé detekce vzájemně propojit napříč vícero kamerami. Nejdříve si představíme principy Single-camera tracking (SCT), jejichž výstupem jsou sekvence detekcí chodců tak, jak v čase procházeli zorným polem té, čí oné kamery. Naším úkolem je najít pro každou osobu vhodné párování jednotlivých sekvencí. V první fázi prezentujeme způsob, kterým lze zakódovat detekci do bodu ve vícerozměrném prostoru. Takové body jsou vzájemně porovnatelné a můžeme díky nim určit míru podobnosti mezi detekcemi. V druhé fázi se zaměříme na párování celých sekvencí a tedy i fungování izolovaných kamer jako celku. Výstupem je seznam korespondujících sekvencí a případné statistiky z nich vyplývající. [[**mozna neco z conclusion**]]

Klíčová slova zpracování obrazu, AI, strojové učení, detekce osob, reidentifikace osob, udržení identity, párování napříč kamerami

Abstract

Object tracking and data extraction in computer vision is an interesting field of research with a wide range of applications. Our goal is to collect statistics of people moving through spacious complexes, such as shopping malls or office buildings. The real value truly rests within the data, which we can utilize for various predictions, like queue prevention or shop placement. However, in such a convoluted building, it is necessary to develop a network of cameras that will monitor all critical areas. In this thesis, we propose a method to interconnect independent detections over multiple cameras with a possible field of view intersection. Firstly, we introduce the essence of our SCT, which provides us a series of pedestrian detections as they pass beneath separate sensors. Such series are called tracks. Our task is to deliver the best matching of individual tracks for each person. The first phase of our method suggests a way to represent or encode detection to a point in multidimensional space. Such points are mutually comparable and we can determine the degree of similarity between detections by their distance. In the second phase, we offer a solution to the inter camera matching and we make the set of isolated cameras work as a whole. Finally, the output is a list of corresponding tracks. In addition, we present some statistics resulting. **[[maybe something from the conclusion]]**

Keywords camera vision, AI, machine learning, people detection, pedestrian reidentification, identity perseverance, inter camera matching

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