TEL AVIV UNIVERSITY אוניברסיטת תל-אביב
הפקולטה להנדסה ע"ש איבי ואלדר פליישמן
THE IBY AND ALDAR FLEISCHMAN FACULTY OF ENGINEERING
המחלקה להנדסת תעשייה
DEPARTMENT OF INDUSTRIAL ENGINEERING

יום עיון

לתלמידי מחקר

5.1.2016

בניין וולפסון – חדר 206

09:00-10:00 מושב א'
רעות נוחם - בהנחיית פרופ' מיכל צור Realistic pre-disaster planning in humanitarian supply chains
שוקי כהן - בהנחיית ד"ר ארז שמואלי Incentivizing safer driving using peer-pressure
יוסי לוזון - בהנחיית פרופ' יבגני חמלנצקי Optimal control of a two-server flow-shop network
10:00-10:20 – הפסקה (כיבוד קל)
10:20-11:20 מושב ב'
דין לנגסם - בהנחיית ד"ר ארז שמואלי Optimizing vaccination allocation for pertussis in Israel
נטע רגר – בהנחיית ד"ר ערן טוך ופרופ' נעם שומרון Privacy in personalized genetic information
אלון סלע – בהנחיית פרופ' עירד בן גל Information spread in the 21st century
11:20-11:40 – הפסקה (כיבוד קל)
11:40-12:40 מושב ג'
יוני בירמן - בהנחיית ד"ר ערן טוך Privacy management through dimension reduction
יפעת דואק – בהנחיית פרופ' עירד בן גל וד"ר טל רביב A combinatorial approach for sensors selection
איציק מזא"ה - בהנחיית ד"ר ארז שמואלי A personal data store based recommender system
12:40-13:00 – הפסקה (כיבוד קל)
13:00-13:45 פגישה עם סגל המחלקה
הסברים כלליים על המסלול הישיר לתואר שני ומידע על תחומי המחקר מיועד למועמדים למסלול ישיר וכן לסטודנטים לתואר שני שעוד לא בחרו נושא לעבודת גמר

Realistic Pre-Disaster Planning in Humanitarian Supply Chains

Reut Noham, Michal Tzur

Humanitarian logistics is an emerging field that addresses the major challenges in providing humanitarian relief operations for both natural and man-made disasters. Strategies to overcome these challenges include disaster preparedness and response, under high uncertainty and limited availability of resources and infrastructure to address needs.

Existing models in the academic literature address network design and resource allocation challenges that are relevant to pre- and post-disaster situations, respectively. However, they adopt a global optimization point of view, which may not be attainable, due to the actual decision making process. The latter is based mostly on practitioners' knowledge and experience, simple rules of thumb, and the local population behavior. Moreover, decision-making in practice is affected by the presence of multiple stakeholders who often have different objectives that are not necessarily aligned.

In our work, we develop new mathematical models that model practical considerations such as those mentioned above. For small/medium instances of the considered problem we present an efficient optimal solution method while for large instances we use heuristic algorithm which is based on Tabu search.

Our results demonstrate that the effectiveness of network design decisions (made at the pre-disaster phase) is sensitive to post-disaster decisions, and therefore, to the extent possible, it is critical to accurately model/predict post-disaster decisions during the pre-disaster phase.

Incentivizing safer driving using peer-pressure

Shuki Cohen, Erez Shmueli

Car crashes have a tremendous toll on human life and the economy. In particular, company car drivers were shown to be 50% more likely to be involved in car crashes compared to other drivers, even after controlling for the larger distances they drive. Therefore, improving driving behavior in fleet companies may have a high impact on road safety.

In order to decrease risky driving two complimentary efforts are needed:

1. An effective measure for evaluating driving behavior. This can be achieved by analyzing data from in-vehicle data recorders (IVDR) that are commonly available in company vehicles. IVDRs allow the collection of various driving patterns such as aggressive driving, impaired driving, speeding, and more. We plan to utilize these data for evaluating driving behavior and generating driving scores for the drivers.
2. An effective incentive scheme to encourage driving behavior changes. Previous studies have mainly focused on machine automated feedback and individual monetary incentives. Instead, we propose a new scheme for promoting safer driving behavior using social incentives that are based on applying a high level of peer-pressure.

We plan to test our suggested evaluation method and social incentive scheme in a live experiment in a major fleet company in Israel. We anticipate that the effectiveness of the social incentive scheme will outperform the individual monetary incentive scheme, amplifying people's willingness to avoid risky driving patterns using the same levels of monetary rewards.

Optimal control of a two-server flow-shop network

Eugene Khmelnitsky, **Yossi Luzon**

We suggest a new, intuitive, and simple method for scheduling jobs in a two-server flow-shop network (FSN) with the minimum makespan objective. Multiple types of jobs with corresponding constant service times arrive at the network at various times over a finite time interval. An analog fluid network is proposed and its optimal fluid control policy determined. We make use of this optimal control policy to suggest a new method for scheduling jobs in the original discrete FSN and prove its asymptotic optimality.

The method is particularly attractive because it falls into the class of easy-to-implement and computationally inexpensive on-line algorithms. Numerical simulations are used to evaluate the performance of the suggested method and show that it performs optimally in almost all simulated instances. Some additional properties of the network are discussed and illustrated.

Optimizing Vaccination Allocation for Pertussis in Israel

Dean Langsam, Erez Shmueli

Pertussis, also known as whooping cough, is a highly contagious bacterial disease that primarily affects infants. Globally, the disease is responsible for over 200,000 deaths annually in children under five. Despite vaccination against the disease, over the past decade, reported pertussis incidence has risen in the developed countries. Furthermore, regardless of a similar vaccination policy, the per capita incidence observed in Israel is 2-4 times higher than incidence observed in the U.S. Therefore, revisiting existing vaccination policies on a country-specific basis is essential.

The first part of this study aims at evaluating the actual extent of pertussis in Israel. To achieve this aim, we analyze reported cases of pertussis accumulated for nearly two decades in the surveillance systems of the Israeli Ministry of Health (IMoH) throughout the entire country. Using Markov chain Monte Carlo, We find that the pertussis incidence were quadrupled and follow a four-year pattern of periodicity. Moreover, our findings could not be better explained by human factors such a misclassification or under reporting.

The second part of this study aims to offer a total vaccination policy to reduce morbidity and mortality. We develop an age-structured continuous-time Markov processes of pertussis transmission in Israel. Our model integrates the primary IMoH data alongside a large dataset (over 2 TB) of private cellphone based GPS traces to accurately capture mobility as well as the contact mixing patterns of the Israeli population. In our future work, we will finalize the construction of the transmission model, and run simulation studies to optimize vaccine effectiveness in Israel.

In light of our preliminary findings, and supported by our collaborators from the IMoH, our model is predicted to shape pertussis immunization policy in Israel.

Protecting Privacy in Personalized Genomic Information

Netta Rager, Eran Toch, Noam Shomron

Recent advances in genomic technology, computing and analysis, enable large-scale genome sequencing for research and clinical care. The use of large genetic databases is projected to have a significant impact on research and medical care. Sharing this data is a stepping-stone for advancing diagnosis and treatment, which brings about growing concerns about data protection and privacy. The limitations of anonymity in genomic data prevent existing solutions to be effective in protecting privacy in large-scale genomic databases. Thus, in order to allow genomics and privacy to walk hand-in-hand, we set an interpretive system that provides conditional access and provenance based on a mechanism that analyzes the sensitivity of the genetic information, together with query- and data-based parameters. This practice can prevent queries that harm the subjects' privacy and provide recourse and accountability in case privacy is harmed. During this process, we are able to map and identify sensitive information in the human genome, tie the biological content of the sequence information to its potential for harms, and then combine it with demographical, social and personal content. Overall, our ranking of genomic loci will allow initial understanding of the interplay between benefit versus privacy risks when exposing this type of information; could be used for setting the ground for a basic set of regulations for new genetic databases; assist in defining what ought to be kept private; raise new issues for individuals to consider when giving biological samples; and, will draw an overall classification map of the dynamic landscape in genomic privacy.

Information spread in the 21st century

Irad Ben-Gal**, Alon Sela**

Alike our Homo-Sapiens ancestors which were Hunters & Gatherers, the modern man is hunting and gathering for information which is his/hers potential source for profits and successes.

The modern man gathers information from two major sources: Word of Mouth or by searching it with search engines on the internet.

The following work compares the process of information spread (and search) by word of mouth to the process of information spread by search engines.

Starting from theoretical modeling, followed by simulative experiments and finalizing by human subjects experimental results, we conclude that the over-use of internet as a single source for information is likely to result in a decrease in the total number of existing ideas and solutions in the population, and that novel ideas/products should benefit from investing the spreading effort (at least partly) in Word of Mouth spread.

Privacy management through dimension reduction

Yoni Birman, Eran Toch

The era of data collection using different sensors has brought us to a point where almost everything we do can be monitored, predicted and classified. Large companies and corporations invest enormous amounts of money in data storage, and even more in data analysis and data mining. Longitudinal behavioral data generally contains a significant amount of structure. Revealing the structure of different activities we do such as browsing, movement, purchasing and more is worth a lot of money to companies who would like to use this knowledge to interrupt, intrude and interfere our lives.

This research aims to resolve two issues for both the companies and corporations who holds the data from the sensors and usually sells or share the data to the "adversaries "(companies who use this data to interfere our lives for economic reasons) and the "normal person" who would like to keep his privacy a bit better.

The first stage of the research was proving that using dimension reduction method called Principal Component Analysis over a location based data base of a cellular company will reduce significantly the amount of data needs to be stored by the companies which will also reduce computational time and resources needed for the data mining process.

The second stage was about generating a controlled privacy mechanism that uses the reduced data and its features when revealing it to the adversaries. In this stage we use clustering method called K-means for comparing and proving the thesis of weather privacy can be controlled only by transforming the data to reduced data using Principal Component Analysis.

A combinatorial approach for optimal sensors selection

Iran Ben-Gal**, Yifat Douek-Pinkovich,** Tal Raviv

We consider a system that can be in of one few unobservable states. There is a set of sensors that can be installed and a cost is associated with the installation of each sensor. We are given the set of all the possible readings of these sensors if installed in the system. Each reading is associated probabilistically with the various states. A cost is associated with each type of identification error, i.e., identifying state A while the system's state is B. The goal is to select a subset of the sensors to be installed such that the sum of the expected error cost and the cost of the selected sensors is minimized. This kind of design problem may arise in various situations. E.g., in the automobile and aerospace industries and in medical diagnostics.

While small instances of the problem can be solved by a complete enumeration of all the possible sensor configurations and partial readings (aka, signatures) the dimension of the search space grows very rapidly with the size of the problem. Therefore, we propose a Cross-Entropy heuristic, which generates and "calibrates" the system selection for "better" configurations iteratively. Numerical studies and simulations show that such a heuristic is not only fast, but also effective in achieving near optimal solutions.

For the special case where the association of readings to states is deterministic we present an integer programming model along with a smart pre-processing scheme that enable solving to optimality large instances of the problem.

A Personal Data Store Based Recommender system

Itzik Mazeh, Erez Shmueli

Recommender systems have become extremely common in recent years, and are applied in a variety of applications such as movies, e-commerce, etc. Existing recommender systems exhibit two major limitations: (1) Privacy - each service ("application") which implements a recommender system requires a database that contains information about all the users of the service. (2) Partial view – when recommending to users, each such service can rely only on the data that was collected by the service itself and it does not have access to other data collected about the user.

The Open Personal Data Store (OpenPDS) architecture was recently suggested for storing personal data in a privacy preserving way. Inspired by the OpenPDS architecture, we suggest an architecture for content-based recommender systems that overcomes the two limitations mentioned above. The suggested architecture allows users to manage and gain control over their own data, and at the same time allows the recommender system to utilize the rich data collected about the user (potentially through other services) to produce more accurate recommendations in a privacy preserving manner.

We plan to implement a prototype of the system and evaluate it through live experiments. Specifically, we plan to: check whether modeling users, while using multiple data sources, produce more accurate models; investigate which aspects of the users' profiles are achieved by each data source; and test whether multi-source-based recommendations perform better than single-source-based recommendations.