A Concept Discovery Approach for Fighting Human Trafficking and Forced Prostitution

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Abstract. Since the fall of the Iron curtain starting in 1989 in Hungary, millions of Central and Eastern European girls and women have been forced to work in the European sex industry (estimated 175,000 to 200,000 yearly[1]). In this paper, we present our work with the Amsterdam-Amstelland (Netherlands) police to find suspects and victims of human trafficking and forced prostitution. 266,157 suspicious activity reports were filed by police officers between 2005 and 2009 that contain their observations made during a police patrol, motor vehicle inspection, etc. We used FCA to filter out interesting persons for further investigation and used the temporal variant of FCA to create a visual profile of these persons, their evolution over time and their social environment. We exposed multiple cases of forced prostitution where sufficient indications were available to obtain the permission from the Public Prosecutor to use special investigation techniques. This resulted in a confirmation of their involvement in human trafficking and forced prostitution resulting in actual arrests being made.

1 Introduction

Irina, aged 18, responded to an advertisement in a Kiev, Ukraine newspaper for a training course in Berlin in 1996. With a fake passport, she traveled to Berlin, Germany where she was told that the school had closed. She was sent on to Brussels, Belgium for a job. When she arrived she was told she needed to repay a debt of

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[1] Eerste rapportage Nationaal Rapporteur Mensenhandel
   http://www.bnrm.nl/Images/Rapportage%201%20(Ned)_2002_tcm63-83113.pdf

US$10000 and would have to earn the money in prostitution. Her passport was confiscated, and she was threatened, beated and raped. When she didn't earn enough money, she was sold to a Belgian pimp who operated in Rue D'Aarschot in the Brussels red light district. When she managed to escape through the assistance of police, she was arrested because she had no legal documentation. A medical exam verified the abuse she had suffered, such as cigarette burns all over her body (Hughes et al. 2003).

The above story is a typical example of a woman of Eastern Europe who was forced into the European sex industry. Rough estimates suggest that 700,000 to 2 million women and girls are trafficked across international borders every year (O'Neill 1999, U.S. Department 2008). The majority of transnational victims are trafficked into commercial sexual exploitation. Human trafficking is the fastest growing criminal industry in the world, with the total annual revenue for trafficking in persons estimated to be between $5 billion and $9 billion (United Nations 2004). The council of Europe states that "people trafficking has reached epidemic proportions over the past decade, with a global annual market of about $42.5 billion" (Equality division 2006). The most popular destinations for trafficked women are countries where prostitution is legal such as the Netherlands (Hughes 2001). According to Shelley et al. (1999) most of these women are in conditions of slavery. Girls of Dutch nationality who were forced to work in prostitution in Amsterdam typically fell prey to a loverboy. The loverboy is a relatively new phenomenon (Bovenkerk et al. 2004) in the Netherlands. A loverboy is a man, mostly with Moroccan, Antillean or Turkish roots who makes a girl fall in love with him and then uses her emotional dependency to force her to work as a prostitute.

In this paper we report on our Formal Concept Analysis (FCA)-based (Ganter et al. 1999) efforts for identifying unknown suspects and victims of human trafficking and forced prostitution in the police region Amsterdam-Amstelland in the Netherlands. Since the introduction of Intelligence Led Policing (Collier 2006, Viaene et al. 2009) in 2005, a management paradigm for police organizations which aims at gathering and using information to allow for pro-active identification of suspects, police officers are required to write down everything suspicious they noticed during motor vehicle inspections, police patrols, etc. These observational reports, 34,817 in 2005, 40,703 in 2006, 53,583 in 2007, 69,470 in 2008 and 67,584 in 2009, may contain indications that can help reveal individuals who are involved in human trafficking, forced prostitution, terrorist activities, etc. However, till date almost no analyses were performed on these documents.

We first used concept lattices to visualize the observational reports and distill interesting indicators and concepts that can be used for tracking down suspects. For each person mentioned in these reports, a document vector was constructed containing all relevant attributes or indicators that were found in the data. This concept lattice in which all available information for each person was gathered, revealed some cases where there were sufficient indications for starting an in-depth investigation. We applied FCA and its temporal variant to zoom in on some real life cases and suspects, resulting in actual arrests being made and/or illegal prostitution locations closed down.

In section 2 we give background information on human trafficking, forced prostitution and the guidelines that were developed by the Attorney Generals of the

Netherlands to help detect trafficking and loverboy suspects. In section 3 we describe the dataset. In section 4 we describe our analysis method to detect and profile potential suspects. In section 5 we describe some real life cases where the suspects were found with FCA. Finally, section 6 concludes the paper.

2   Human Trafficking and Forced Prostitution

Victims of human trafficking rarely make an official statement to the police. The human trafficking team of the Amsterdam-Amstelland police is installed to proactively search police databases for any signals of human trafficking. Unfortunately, this turns out to be a laborious task. The investigators have to manually read and analyze the police reports, one by one, because only an estimated 15% of the information containing human trafficking indications has been labeled as such by police officers. As soon as the investigators find sufficient indications against a person, a document based on section 273f of the code of criminal law is composed for the person under scrutiny. Based on this report, a request is sent to the Public Prosecutor to start an in-depth investigation against the potential suspects. After permission is received from the Public Prosecutor, the use of special investigation techniques such as phone taps and observation teams is allowed.

The following list contains the types of indications mentioned in the guidelines developed by the Attorney Generals of the Netherlands based on which police forces can gather evidence of human trafficking and forced prostitution against potential suspects. These guidelines define in which cases pro-active intervention by police may be necessary. This information had not yet been used to actively search police databases for suspicious activity reports containing human trafficking indicators.

1. Dependency on exploiter: Typically in human trafficking the housing, clothing and transportation of the woman are arranged through the exploiter, the woman will often have debts towards the exploiter and will be forced to earn the money back.
2. Deprivation of liberty: Often the victim is not allowed to have contact with the outside world. She typically does not have her passport with her which is carried by the pimps.
3. Being forced to work under bad circumstances: The victim has to work for many hours, cannot freely dispose of the money she earns, etc.
4. Violation of bodily integrity of the victim: The victim is forced to work as a prostitute through physical violence, threatening, etc.
5. Non-incidental pattern of abuse by suspect(s) can be observed.

3   Dataset

Our dataset consists of 266,157 suspicious activity police reports, 34,817 in 2005, 40,703 in 2006, 53,583 in 2007, 69,470 in 2008 and 67,584 in 2009. These police reports are stored in the police databases as unstructured text documents and have the following associated structured data fields: title of the incident, project code assigned by the responsible officer, location of the incident and optionally a formally labeled suspect, victim and/or other involved persons. The unstructured part of these

suspicious activity reports describes observations made by police officers during motor vehicle inspections, during a police patrol, when a known person was seen at a certain place, etc. These reports were extracted from the database and turned into html documents that were indexed using the open source engine Lucene.

The thesaurus constructed for this research contains the terms and phrases used to detect the presence or absence of indicators in these police reports. This thesaurus consists of two levels: the individual search terms and the term cluster level which was used to create the lattices in this paper. We used a semi-automated approach as described in (Poelmans et al. 2010a). Search terms and term clusters were defined in collaboration with experts of the anti-human trafficking team and gradually improved by validating their effectiveness on subsets of the available police reports. Each of these search terms were thoroughly analyzed for being sufficiently specific. The quality of the term clusters was determined based on their completeness. The validation of the quality of the thesaurus and the improvements were done by us and in conjunction with members of the anti-human trafficking team. Concept structures were created on multiple randomly selected subsets of the data. It was manually verified if all relevant indicators were found in these reports and no indicators were falsely attributed to these reports. For example, the term cluster "prostitute" in the end contained more than 20 different terms such as "prostituee", "dames van lichte zeden", "prosti", "geisha", etc. used by officers to describe a prostitute in their textual reports. To create the formal contexts in this paper, the term clusters in the thesaurus were used as attributes and the police reports as objects. A prototype of the FCA-based toolset CORDIET (which is currently being developed under a collaboration between KULeuven and Moscow Higher School of Economics) was used during the analysis process (Poelmans et al. 2010d).

4   Method

Our investigation procedure consists of multiple iterations through the square of Fig. 1. For background information on FCA and its applications in KDD we refer the reader to Poelmans et al. (2010c). The guidelines of section 2 contain a non-limitative list of indications and the indications can be subdivided into 5 main categories. If at least one of the thesaurus elements corresponding to these indications is present for a person or a group of persons, we might be dealing with a case of human trafficking or forced prostitution. From the 266,157 reports in our dataset, the relevant reports which contain at least one indicator are selected. Then, the persons mentioned in these reports are extracted and FCA lattices are created, showing all the indications observed for each person. From these lattices containing persons, potential suspects or victims can be distilled and they can be further analyzed in detail with FCA and temporal concept lattices. If sufficient indications are available, a document based on article 273f of the code of criminal law can be created and sent to the Public Prosecutor with the request for using advanced intelligence gathering instruments such as observation teams, phone taps, etc. If the suspects are indeed involved in human trafficking and forced prostitution they can be taken into custody.
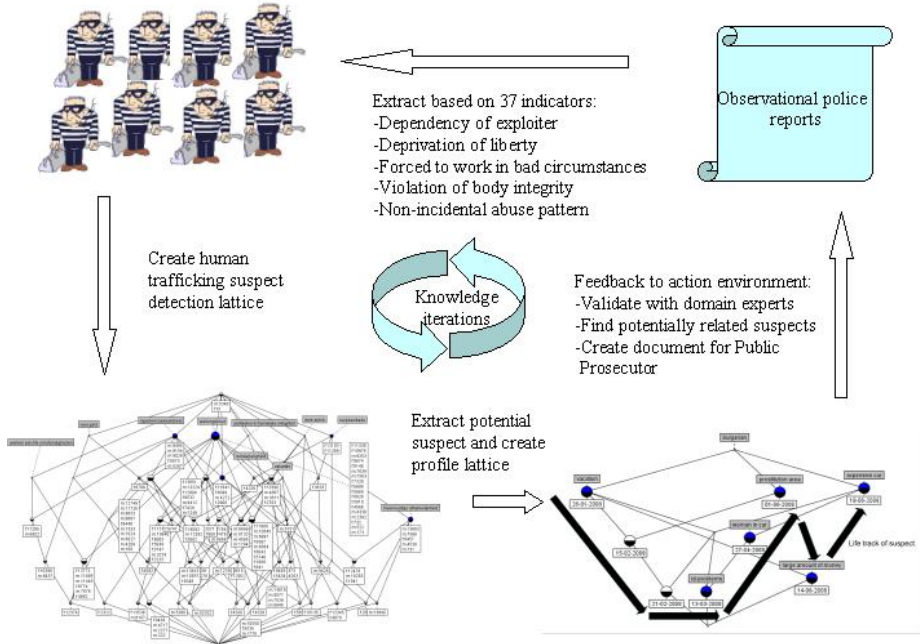
Fig. 1. Criminal intelligence process

Our method based on FCA consists of 4 main types of analysis that are performed:

- **Concept exploration of the forced prostitution problem of Amsterdam:** In (Poelmans et al. 2010a, Poelmans et al. 2010b) our FCA-based approach for automatically detecting domestic violence in unstructured text police reports is described in detail. We not only improved the domestic violence definition but also found multiple niche cases, confusing situations, faulty case labelings, etc. that were used to amongst others improve police training. Part of the research reported on in this paper such as the construction of the thesaurus, consisted of repeating the procedures described in our domestic violence case study papers.

- **Identifying potential suspects:** Concept lattices allow for the detection of potentially interesting links between independent observations made by different police officers. When grouping suspicious activity reports on a per person basis, the available information about the individuals is displayed in one intuitive and understandable picture that facilitates efficient decision making on where to look. In particular persons lower in the lattice can be of interest since they combine multiple early warning indicators.

- **Visual suspect profiling:** Some FCA-based methods such as Temporal Concept Analysis (Wolff 2005) were developed to visually represent and analyze data with a temporal dimension. Temporal Concept lattices were used in (Elzinga et al. 2010) to create visual profiles of potentially interesting terrorism subjects. Scharfe et al. (2009) used a model of branching time in

which there are alternative plans for the future corresponding to any possible choice of a person and used it as the basis of an ICT toolset for supporting autism diagnosed teenagers. For creating the temporal profile of individual suspects, we use traditional FCA lattices and the timestamps of the police reports on which these lattices are based are used as object names. The nodes of the concept lattice can then be ordered chronologically.

- **Social structure exploration:** Concept lattices may help expose interesting persons related to each other, criminal networks, the role of certain suspects in these networks, etc. With police officers we discussed and compared various FCA-based visualization methods of criminal networks. Individual police reports mentioning network activity were used by us as objects and the timestamps of these police reports together with each suspect name mentioned in these reports as object names.

5   Analysis and Results

Traditional data mining techniques often focus on automating the knowledge discovery process as much as possible. Since the detection of actual suspects in large amounts of unstructured text police reports is still a process in which the human expert should play a central role, we did not want to replace him, but rather empower him in his knowledge discovery task. We were looking for a semi-automated approach and in this section we try to illustrate the main reasons why FCA was ideal for this type of police work. With FCA at the core, we were able to offer police officers an approach which they could use to interactively explore and gain insight into the data to find cases of interest to them on which they could zoom in or out. Section 5.1 shows a lattice diagram which was of significant interest to investigators of the anti-human trafficking team. For the first time, the overload of observational reports was transformed into a visual artifact that showed them a set of 1255 persons potentially of interest to the police and the indicators observed for each of them. The lattice diagram visually summarizes the data and makes it more easily accessible for officers who want to efficiently explore it and extract unknown suspects. We chose to first highlight the case of the Turkish human trafficking network in section 5.2. From the lattice diagram in section 5.1, two potential suspects were distilled since they were regularly spotted performing illegal activities. We found the name of a bar was mentioned a couple of times and used this information to build the concept lattice of section 5.2. This lattice diagram was of particular interest to police officers since FCA quickly gave them a concise overview of the persons that were observed to be involved around a suspicious location and the lattice structure helped them to identify the most important suspects in this network. In particular the visualization of persons in a lattice was helpful during their exploration. FCA's partial ordering gave them clues on where to look first. The lower a person appears in the lattice, the more indicators he has. Section 5.3 showcases how the FCA visualization was used to combine temporal and social structure information in one easy to interpret picture. Such profile lattices were of significant interest to police officers since they allow for quick decision making on whether or not a person might be involved in illegal activities. Moreover, the lattices may help infer the roles of the persons mentioned in

the network. Finally section 5.4 shows how an FCA lattice can give insight into the evolution of a person over time, in this case of a loverboy. The remaining part of this section describes cases of human trafficking and forced prostitution and two of them were identified in the lattice in Fig. 2 and further investigated with FCA. Note that real names were replaced by false names because of privacy reasons.

5.1 Detection of Suspects of Human Trafficking and Forced Prostitution

Multiple concept lattices were created for detecting human trafficking suspects in the set of persons. Each of these concept lattices contained over 200 concepts and were based on different combinations of attributes. Since the format of this paper does not allow to visualize the entire lattices in a readable way, we chose to simplify one of these lattices and zoomed in on its most important aspects. Fig.2. contains the lattice diagram with 1255 Bulgarian, Hungarian and Romanian persons. The concept containing some of the suspects of section 5.2 was found on the right and bottom part of the lattice and has 10 persons in its extent. The concept containing the main suspect
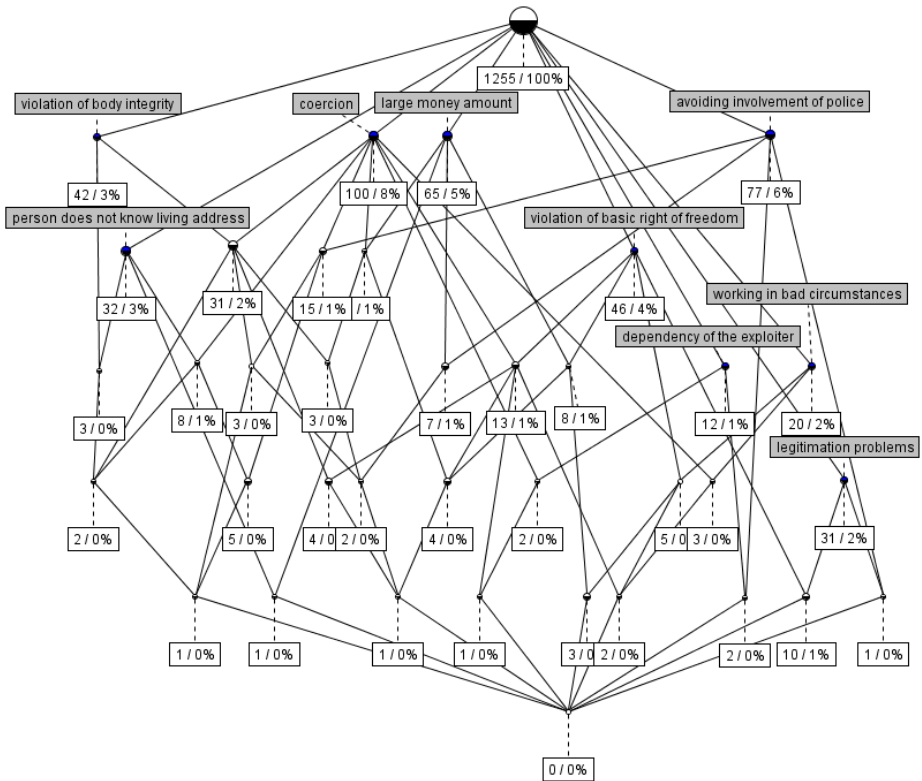

Fig. 2. Human trafficking suspect detection lattice diagram

of section 5.3 was found on the left and bottom part of the lattice and has 1 object in its extent. The following 2 sections will be used to describe and profile each of these suspects in detail.

5.2   Case 1: Turkish Human Trafficking Network

By analyzing the concept lattice based on observational reports, we were able to expose a criminal network operating in Amsterdam, involved in illegal and forced prostitution. The concept lattice diagram in fig. 3 contains the 61 persons and indicators found in the police reports mentioning activity around a bar in Amsterdam that played a central role in the network's activities and was closed down in 2009. Multiple suspects operating in this network were found and some of the observations will be described in this section. The most important suspects are the persons with indication legitimation problems, since they were carrying the id papers of the girls. The police reports contained many indications of illegal and forced prostitution taking place, activities that were run by the owners or acquaintances of the owners of the bar. We found out the bar was used as a central hub, where mostly Turkish men met up with Bulgarian girls who had been forced into prostitution and took them to another location. We found at least two pimps who have multiple girls working for them.
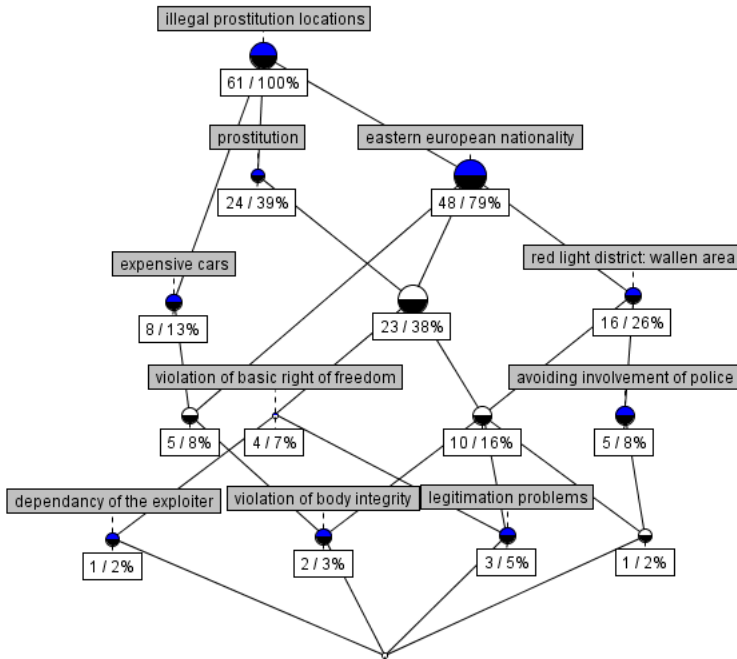

Fig. 3. Concept lattice diagram of human trafficking network

Starting in 2007, the first observations were made that hinted at illegal and forced prostitution being organized from within this bar. On 2 June 2008, victim H declared to the police that she was forced to work as a prostitute in the bar and did not get any money for that. She was never allowed to leave the house alone and the door of her apartment was locked from the outside such that she couldn't leave. On 12 December 2008, suspect A came out of the bar with a girl, their statements to the police did not match and moreover the girl was dressed in sexy clothing. Most likely the girl works as a prostitute and the driver is her pimp. On 25 January 2009, police officers stopped a car and behind the wheel was suspect B and next to him the victim E. We found woman E is often sitting at the bar and also the car is regularly parked in front of the bar. Suspect B gave the passport of victim E to the police and afterwards he placed it back in his pocket. Moreover, suspect B was carrying a large amount of cash money, 1000 euros in his pocket. On 26 January 2009, police did a check-up on the guests in the bar. One girl was new and told she only just arrived by train, she had no train tickets with her and she did not know her living address. Suspect B was also there and told the police he is a car trader so he travels a lot between Bulgaria and Netherlands. An excuse typically used by criminals responsible for the logistics of a trafficking network. Also victim E and two other girls, victims F and G were there. On 20 February 2009, police officers saw suspect A talking to the driver of a car with Bulgarian license plate. Afterwards he forced a girl to follow him and when the police asked about their relationship they told they had been friends for 3 months. The girl did not have her id-papers with her and the police went to her living address. In the house there were many mattresses and another girl. Both of them told they have no job. Most likely the house serves as an illegal prostitution location for the criminal gang.

Sufficient indications were found and on 17 June 2009, an observation team observed the bar during the evening. Eastern European women were sitting at the bar and mostly Turkish, Moroccan and Eastern European men at the tables. During the evening, the team saw multiple girls that were taken out of the bar by a customer to a hotel, house, etc. and brought back to the bar afterwards. On 15 July 2009 sufficient evidence was gathered that illegal prostitution was organized from within this bar and authorities closed down the bar.

5.3   Case 2: Bulgarian Male Suspect

In this section we describe a profile of a Bulgarian suspect who was also operating in Amsterdam. The lattice diagram in Fig. 4 shows that on 3 October 2007, suspect A was observed for the first time during a police patrol. An officer told the driver of a BMW car with Bulgarian license plate to turn right instead of left, the driver however ignored the instructions he received and quickly drove to the left with squeaking tires. The officer went after and in the end stopped the car. There were 3 men and one woman in the car. Suspect B was the driver and suspect A was sitting next to him. On the backseat of the car were woman F and man K. They told the officer they only arrived 3 days ago in the Netherlands and are a couple. Suspect A and suspect B were taken to the police office; man K and woman F walked away and were followed by a second officer. He saw that K was strongly holding the hand of F and forced her into
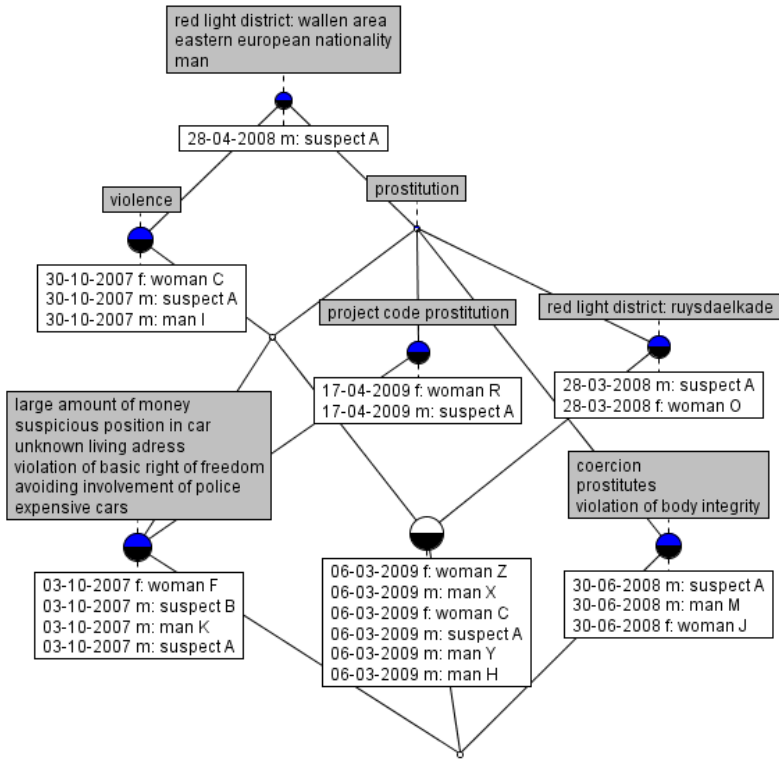
Fig. 4. Profile lattice diagram of individual suspect and his network

a home at the corner of a street in central Amsterdam. In the police office, suspect B was not able to tell the address of the apartment he was going to rent. Suspect A was carrying a large amount of cash money in his pocket.

On 30 June 2009, woman J went to the police to ask if they could supervise the undersigning of a tenancy agreement of an apartment by man M who promised her accommodation. She told suspect A was intimidating and trying to scare away man M because suspect A wanted to rent the apartment for prostitution purposes. She was very afraid of suspect A and the officer noted that she might have been forced in prostitution by him. On 30 October 2007, the police did a routine inspection of 2 individuals who were waiting with two motorcycles in a street that had been plagued by street robberies. This was the second observation of suspect A by the police and his motorcycle was registered by the name of woman C who had been involved in human trafficking activities as a victim. On 6 March 2009 the police received a tip that a fugitive Colombian criminal might be living at a certain address owned by professional criminal H. When they entered the apartment they found 2 men and 2 women of Bulgarian nationality. Man X and woman C declared to be on holiday and would go back to Bulgaria although we found suspect A was driving around with a scooter registered at C's name in 2007. Man Y declared he exports expensive cars to Bulgaria and regularly drives back and forth between Netherlands, an excuse typically

used by suspects taking care of logistics of a human trafficking gang. Woman Z declared to work in prostitution in Groningen. When the officers left the apartment they found a motorcycle registered on the name of suspect A. The last observation dates back to 17 April 2009 when the police saw suspect A call somebody while standing in the entrance hall of prostitute R. He tells the police he has nothing to do with prostitution and owns a restaurant in Bulgaria. After his phone call he gives the cell phone to the prostitute.

To conclude, suspect A and B are most likely involved in human trafficking and there were sufficient signals found to request the use of special investigation techniques. Permission was granted, our suspicions were confirmed and both A and B were arrested by the police in 2010. Moreover these lattices showed some other people who are involved in the same gang and could be monitored.

5.4 Case 3: Loverboy Suspect

In this section we describe a loverboy case which we exposed by gathering evidence from multiple observational reports. This person was not found by analyzing the lattice diagram in Fig. 2 but by investigating a lattice based on Antillean, Moroccan and Turkish persons. Victim V is a girl of Dutch nationality who officially lived in the Netherlands but fell prey to a loverboy of originally Antillean nationality. We found multiple indications in filed suspicious activity reports that referred to elements of the model in section 2. The lattice diagram of suspect A and victim V is displayed in Fig. 5.

On 27-04-2006, Suspect A and victim V were noticed for the first time on the streets during a police patrol. They had a serious argument with each other and suspect A took the cell phone with force out of V's hand. When the police intervened they claimed nothing happened. In the police station she declared that she works voluntarily in prostitution although her words were not convincing to the officer. On 15-08-2006 an Amsterdam citizen sent an email to the police about young Antillean men who constantly surveillance some women in the red light district. Amongst other suspect A brings food and drinks to the women who are not allowed to leave their rooms. On 31-10-2006 during a police patrol, victim V was noticed while she got out of a car and quickly ran inside. The driver of the car was suspect A. She told the police later on that she was brought to and picked up every day at this apartment by her boyfriend suspect A. The police noticed her dismayed and timid attitude and asked again if she was forced to work in prostitution. In a non-convincing way she responded that she did her job voluntarily. On 15-09-2006, suspect A had to stay in jail for 6 hours because of illegal weapon possession. When the police asked about his income he told he earned good money thanks to his girlfriend who works in prostitution. On 2-11-2006, officers noticed the car of victim V was parked on the road and two Negroid men were inside. The driver, suspect A got out of the car and yelled to the girl he was picking up at her apartment, that she had to hurry up. The whole scene looked very intimidating to the police and it turned out the girl was victim V. Suspicious was that the car was registered on the name of V while V had no driver license. On 28-03-2007, victim B came to the police office to ask if she was allowed to work with a badly damaged id-document or if she had to wait for a new one. She mentioned that suspect A was her ex-boyfriend and that she and victim V were the victim of extortion but she did not dare to make an official statement to the
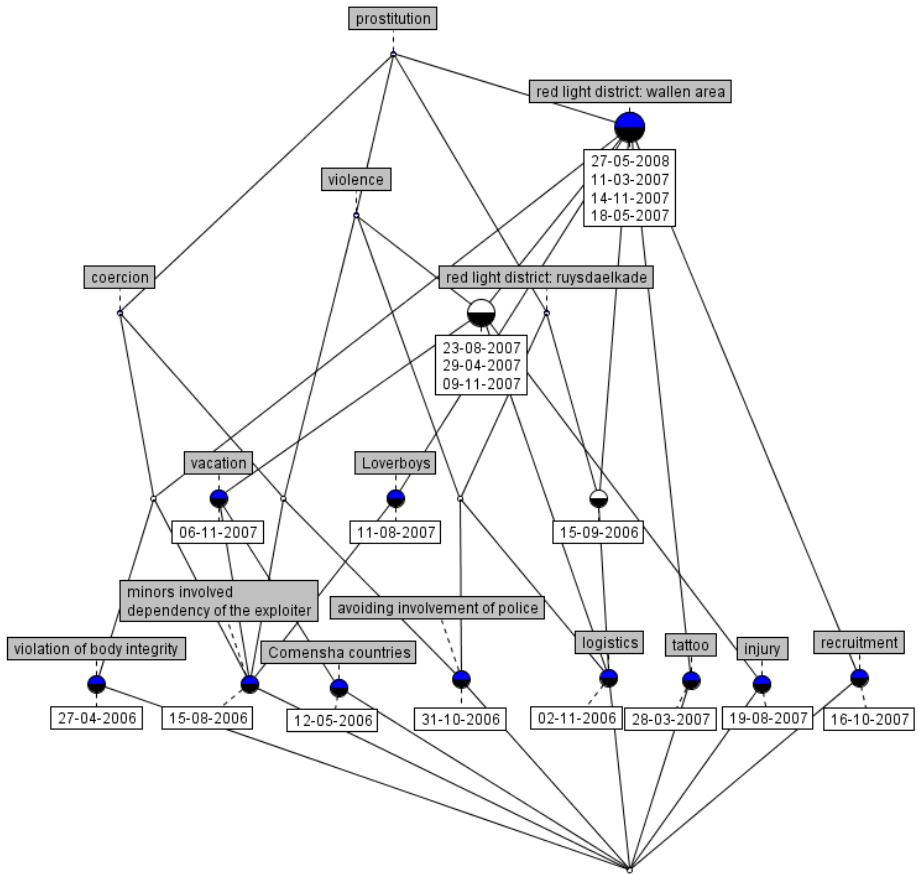
Fig. 5. Profile diagram of loverboy suspect

police. Afterwards, the police checked a home where they found 2 women: victim V and B. Victim V had a big tattoo on her right shoulder and a smaller tattoo on her upper arm. On 19-08-2007, suspect A was involved in a knifing incident in the red light district between 3 men and one of these men got seriously injured. This man wanted sex with victim V but suspect A did not allow this because of the man's ethnicity, which caused the fight. On the camera surveillance videos, victim V was observed to accompany suspect A all the time. On 16-10-2007, officers observed that suspect A who walked over the streets said hi to all women who passed by.

6   Conclusions

Textual documents contain a lot of useful information that is rarely turned into actionable knowledge by the organizations that own these data repositories. The police of Amsterdam-Amstelland disposes of a large amount of such textual reports

that may contain early warning indicators that can help to proactively identify persons involved in illegal activities. Since the observations of one suspect are typically made by different officers who are not aware of each others work, spread over multiple databases, etc. automated analysis techniques such as FCA can be of significant importance for police forces who are interested in the proactive identification of perpetrators. FCA is one of the few techniques that can be used to interactively expose, investigate and refine the underlying concepts and relationships between them in a large amount of data. In this paper we described our successful application of FCA to find suspects of human trafficking and forced prostitution in the Amsterdam-Amstelland police district. From 266,157 observational reports we distilled multiple suspicious cases of which 3 have been described in this paper. For each of these persons and networks we composed a document containing all the indicators and evidence available and sent this to the Public Prosecutor. Permission to use special investigation techniques was obtained by the anti-human trafficking team based on these documents. For each case we exposed, phone-taps, observation teams, etc. indeed confirmed the suspect's involvement in human trafficking and forced prostitution. We believe that in making the shift from reactive police work, where action is only undertaken when a victim comes to talk directly to the police, to the pro-active identification of suspect's, FCA can play an important role.

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