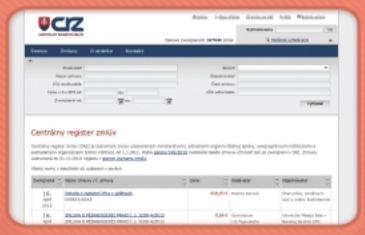
Automated Public Data Refining

Register of companies

Register of organizations

Contracts



Lists of debtors

Cultural grants

Public procurements

Municipality statistics

Database

Internet domains

Business bulletins

Problems

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Field normalization

- squeeze white spaces
- convert to lower cases
- transliterate language-specific chars (č, ť, á)
- extract academic degrees to separate fields
- extract address parts to separate fields

String similarity for typos

- Levenshtein (edit) distance
  - minimum number of edit operations needed to transform one string into another
  - John Dough <=> John Doe (3)
- N-gram similarity
  - break string into n-gram sets (n can be 2, 3, 4, 5, ...)
  - |A intersection B| / |A union B| (jaccard similarity)
  - example
    - John Doe => (__J, _Jo, Joh, ohn, hn_, n_D, _Do, Doe, oe_, e__)
    - John Dough => (__J, _Jo, Joh, ohn, hn_, n_D, _Do, Dou, oug, ugh, gh_, h__)
    - 7 / 15 = 51.42%

Heuristics based on relations

- include relations between compared entities
- e.g. common occurrences in organizations

Methods

- Manually tuned parameters
- Machine learning (supervised, clustering)
- Blocking methods
- User assistance

Experiment 1

- supervised machine learning
- logistic regression classifier
- training and testing on all possible pairs of data set entities

Data set

- 4,298 entities from register of companies (data provided by foaf.sk)
- baseline label
  - current foaf.sk duplicate detection
- attributes
  - name
  - address

Features

- equal names
- equal addresses
- levenshtein distance of names
- levenshtein distance of addresses
- n-gram similarity of names
- n-gram similarity of addresses
- combination of academic degrees
  - feature for every possible pair of occurring degrees
  - testing compatibility of degrees
- disjunction of academic degrees
  - degree occurring in one of two compared samples

Results

Feature set	FP	FN	F_1 score
=(labels)	0	0	1
=(names), =(addresses)	142	13	0.9293
L(names), L(addresses)	326	3	0.9318
2G(names), 2G(addresses)	142	13	0.9293
3G(names), 3G(addresses)	142	13	0.9293
4G(names), 4G(addresses)	142	13	0.9293
5G(names), 5G(addresses)	142	13	0.9293
6G(names), 6G(addresses)	142	13	0.9293
2G(names + degrees), 2G(addresses)	138	40	0.9177
3G(names + degrees), 3G(addresses)	138	46	0.9147
4G(names + degrees), 4G(addresses)	136	50	0.9135
5G(names + degrees), 5G(addresses)	135	53	0.9124
6G(names + degrees), 6G(addresses)	135	54	0.9119
L(names), L(addresses), degree combinations	135	39	0.9194
L(names), L(addresses), degree disjunctions	135	23	0.9274

Conclusion

- developed our evaluation framework
- trained feature weights can be reused by other duplicate detection systems
- machine learning can be used for public data refining

Experiment 2

- new data set
- new features
- support vector machine classifier

Data set

- ~ 250 entities from register of organizations
- 3 hours of work (selection and manual labeling)
- attributes
  - name
  - address
- relations
  - occurrence in a common organization

Features

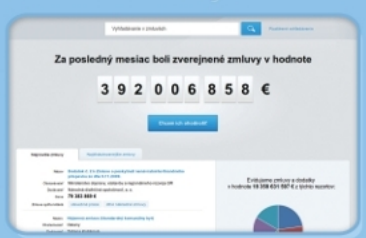
- address-related features broken into separate features for address parts (street, number1, number2, code, town)
- binary feature for occurrence in a common organization
- binary feature for presence of blank address

Preliminary conclusion

- breaking address into parts improves results
- inclusion of heuristics improves results
- degree features don't work due to small data set
- SVM yields better results than logistic regression
- classifier

Foaf.sk

Otvorenezmluvy.sk



Statistiky-domen.sk

Naseobce.sk

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