

Big Data technologies for labour market analysis

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03 October 2019, NEC2019, Budva, Becici, Montenegro

Motivation

Goals

- Automated monitoring of the demands of human resources on the levels of companies, regions, one and many countries
- Discovering qualitative and quantitative correlations between labour market and educational system
- Forecasting the situation on the regional labour markets

Challenges

- Labour market and educational system “speak” different languages
- The data from both sides is not uniform and structured enough

Initial data sources

Labour market

- Recruitment advertisements
- Job postings, CVs

Educational system

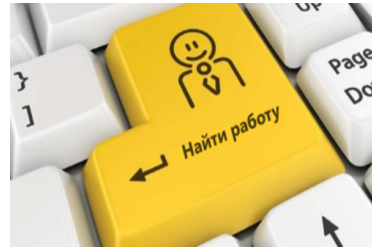
- State educational standards
- Professional standards
- Universities' educational programs
- Expert knowledge on the key points of the professions

Matching professions and educational programs with the labour marker

Работа в России
Общероссийская база вакансий

hh.ru
HeadHunter
SuperJob
AVITO.RU

Job offers database



Professions reference



1. Professions descriptions
2. Links with educational programs and standards

Daily

- 700 thousands open job offers
- 500 thousands CVS

Years 2015-2019

- 50 millions unique job offers
- 2 TB of data



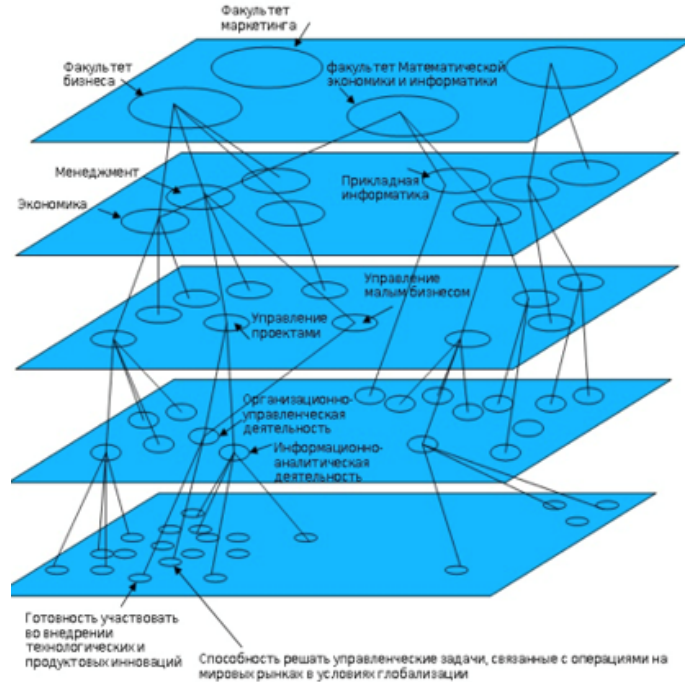
Competences

- People's characteristics allowing them to achieve intended results. Competences are therefore understood as the ability to implement specific patterns of behavior,
- Competences are understood as characteristics of a professional position. This interpretation defines competences as the ability to effectively perform professional duties in compliance with standards established by the organization or to achieve desired results.
- Main groups of competences (Filipowicz, 2014):
 - **social** – how a candidate (an employee) performs tasks related to contacts with other people
 - **personal** – how a candidate (an employee) carries out his duties and organizes his work
 - **professional** (specialist, technical) – what professional knowledge and experience a candidate (an employee) possesses.

From: Sergey Belov, Paweł Lula, Salvatore Ingrassia, Zoran Kalinić, CLADAG“2019, Cassino, September 11-13, 2019

Using competence model to match education with real market needs

Education



Department

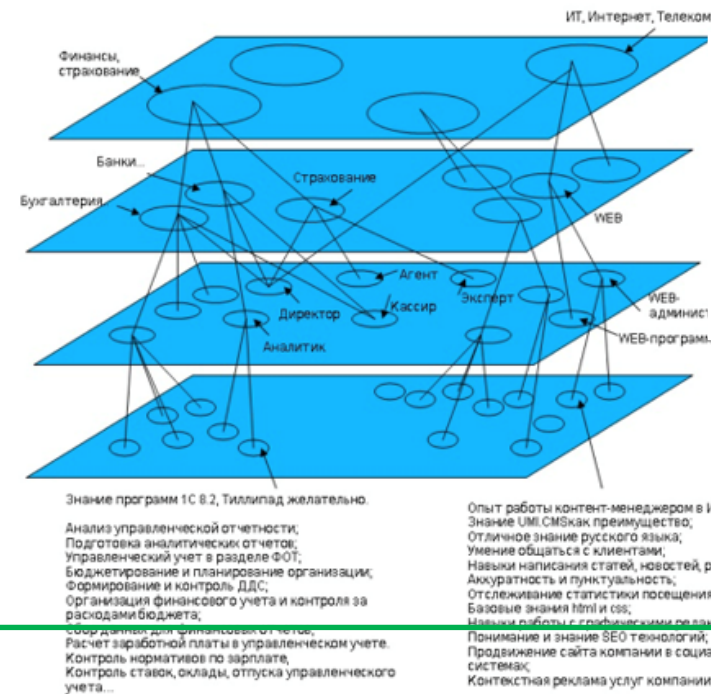
Field of study

Educational profile

Type of activity

Competence

Market



Career field

Focus area

Profession

Requirement

Meanings comparison

What is involved

- Vacancies: title, description, requirements, industrial area, etc.
- Education: competencies, skills, experience, pieces of knowledge, etc.

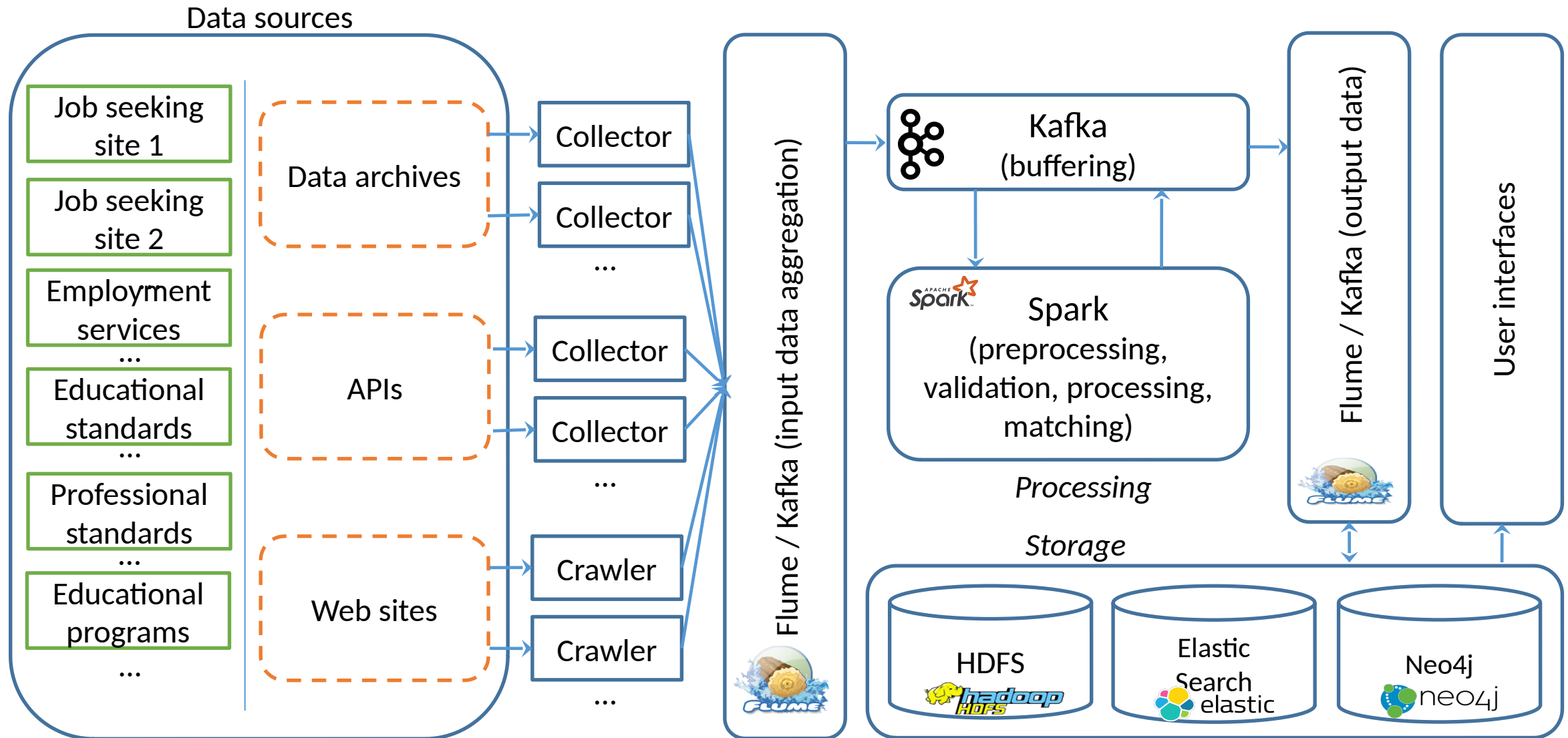
Semantic parsing

- Usually wordings are short (about 10 words)
- Vector representation are in use (*word2vec*)
- Models are based on big general corpora (like *RusVectōrēs* for Russian language) and custom ones built for the semantic areas

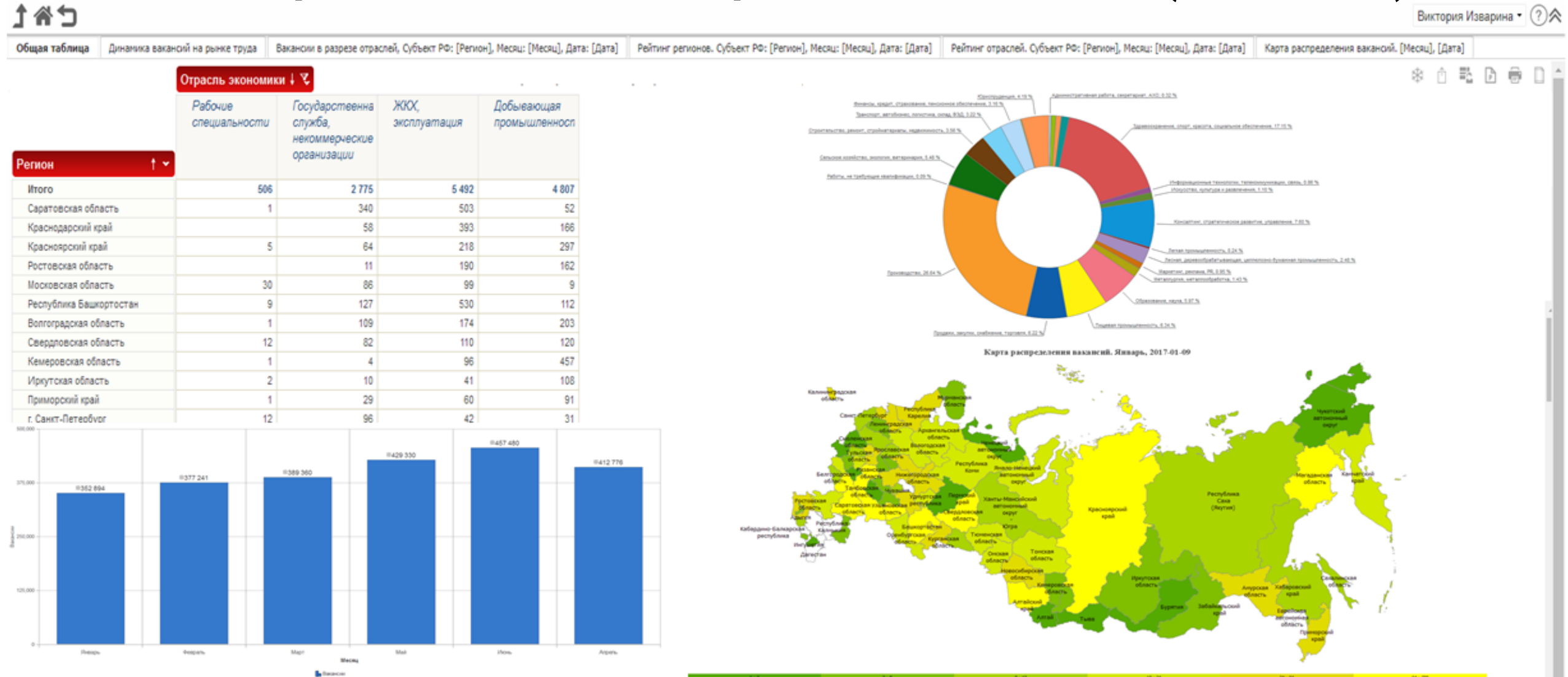
Comparison

- Weighted cosine distance gives good results, however we are considering other approaches at least for validation

Workflow



Monitoring of job offers and professional qualifications (Russia)



Another approach: per-competence ontology-based analysis

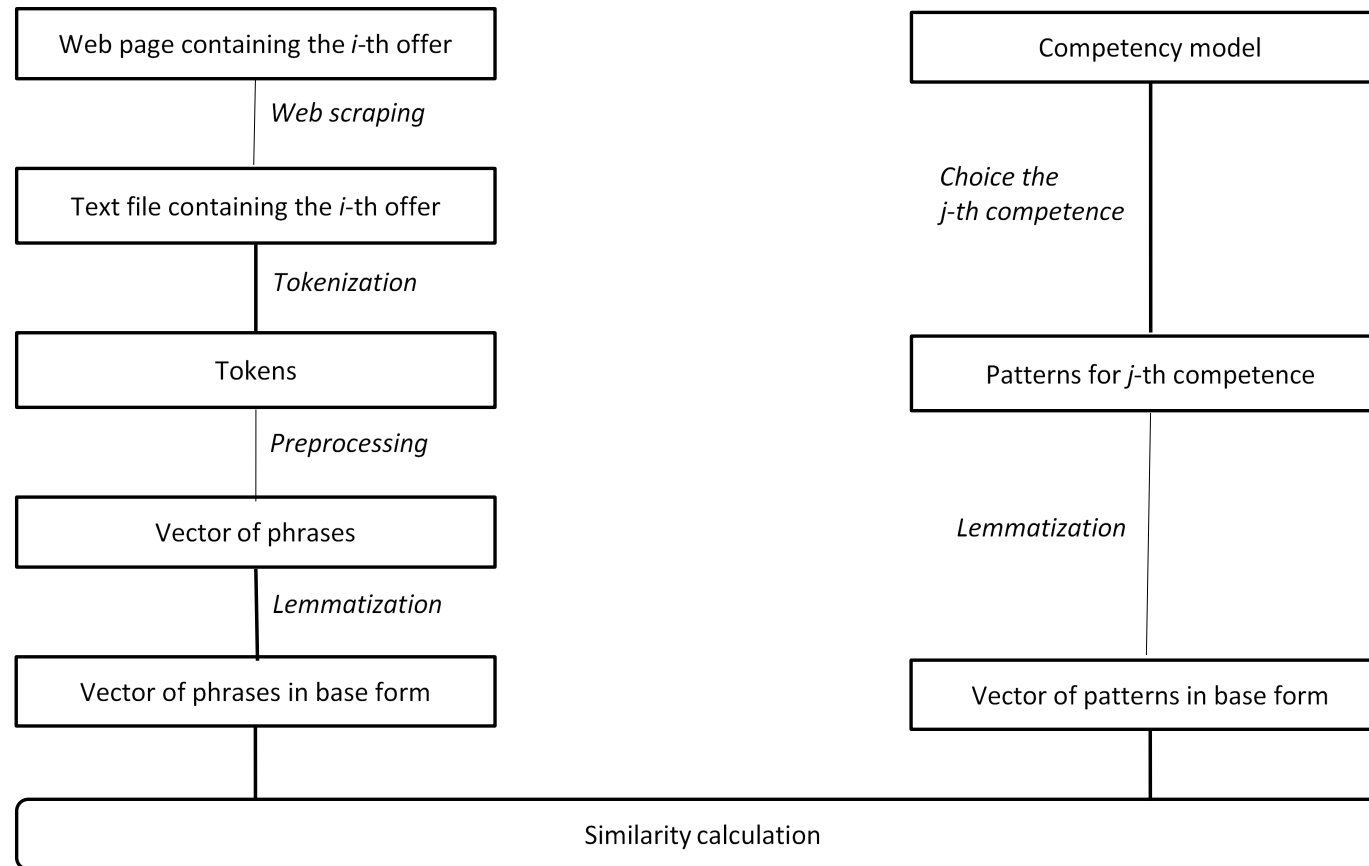
- Comparison of competencies gap in IT area for Polish, Russian, English, Italian, Serbian languages
 - in collaboration with
Cracow University of Economics



Stages of analysis

1. Job offers retrieval
2. Tokenization
3. Definition of competences, Selection of exemplary phrases for competences (TF-IDF at pre-processing)
4. Transformation and text mining analysis
5. Building the ontology

Competence identification process



From: Sergey Belov, Paweł Lula, Salvatore Ingrassia, Zoran Kalinić, CLADAG'2019, Cassino, September 11-13, 2019

Interlingual competences example

```
8 #####
9 ##### SOCIAL COMPETENCIES #####
10 #####
11
12 social:
13
14     communication_skills:
15         description: communication skills
16         phrases_EN:
17             - "#communication #skills"
18             - "#oral #communication"
19             - "#written #communication"
20             - "#clear #communication"
21             - "#effective #communication"
22         phrases_SRB:
23             - "#komunikacione #veštine"
24             - "#sposobnost #komunikacije"
25             - "#komunikativan"
26             - "#usmena #komunikacija"
27             - "#pisana #komunikacija"
28             - "#jasna #komunikacija"
29             - "#efikasna #komunikacija"
30             - "#komunikativan"
31         phrases_PL:
32             - "#swobodna #komunikacja"
33             - "#komunikuje się #swobodnie"
34             - "#wywieranie #wpływu na #rozmówcę"
35             - "#wpływa na #rozmówcę"
36             - "#(umiejętności|zdolności|predyspozycje) #komunikacyjne"
37             - "#potrafi się #komunikować"
38             - "#łatwo #nawiazuje #(kontakt|kontakty|relację|relacje)"
39         phrases_IT:
```

YAML

Sample competences in question

K1: computer system administration, operating systems, computer networks,

K2: computer system security, personal data security

K3: computer programming

K4: information systems

K5: mobile applications

K6: hardware

K7: project management

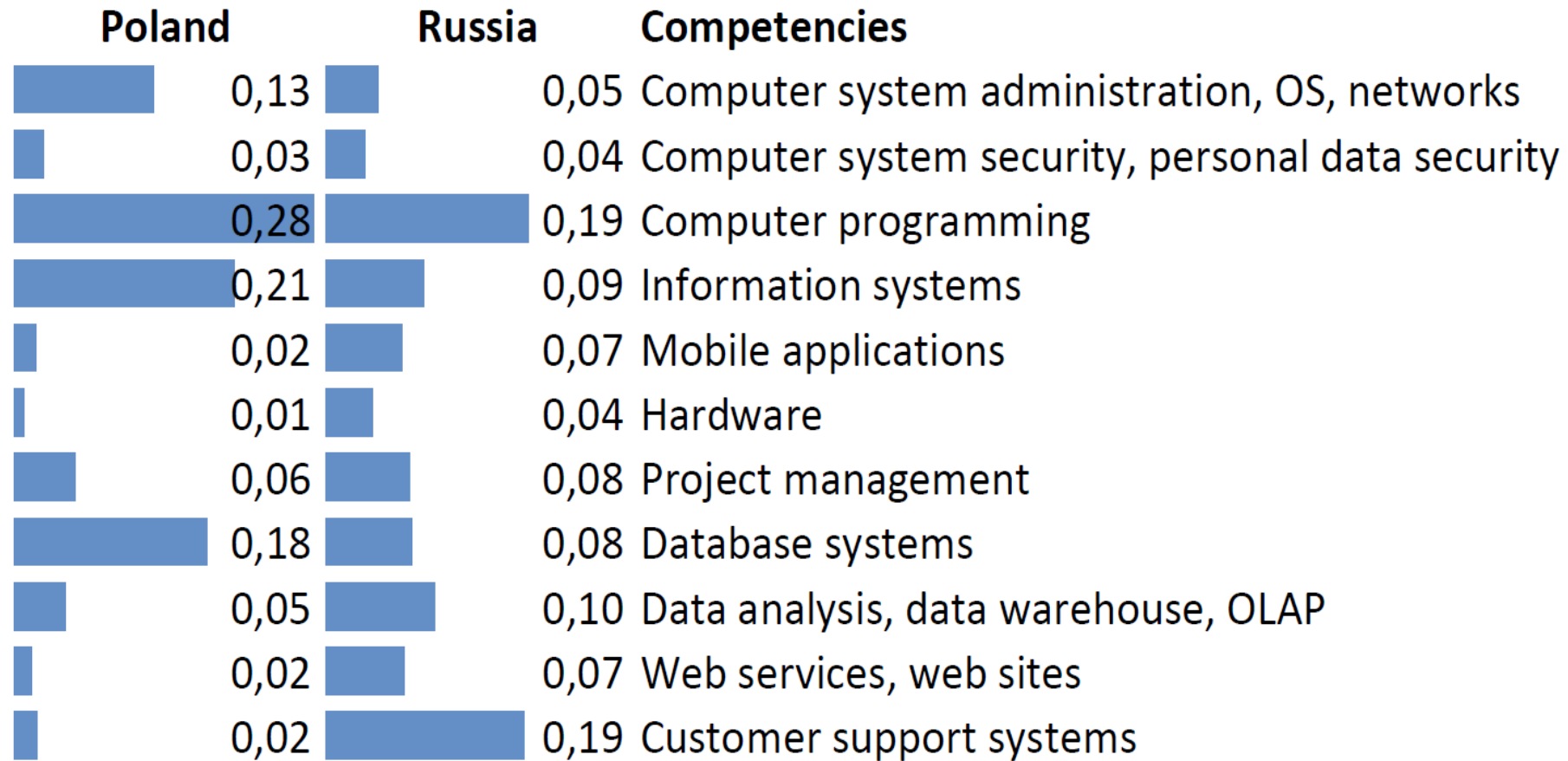
K8: data base systems

K9: data analysis, data warehouses, OLAP

K10: web services, web sites

K11: customer support systems

Example: importance of competencies in system administration and programming



From: S. Belov, K. Wójcik, Automatic Monitoring System for the Competency Gap Evaluation at the Russian and Polish Market, ECDA 2018

Summary

- Implemented labour market monitoring system
 - Real users, e.g. Russian Ministry of Labour and Social Protection, RIA Novosti
- Proposed approach allows to have a quantitative measuring of matching of educational profiles to real market expectations
- Big Data technologies and different converging analysis approaches allows to study and labour markets for several countries

Thank you for your attention!