

Lucerne University of Applied Sciences and Arts

**HOCHSCHULE
LUZERN**

Intelligent Branding for Less Well-Known Enterprises by Matching Culture Values of Employers and Candidates

Guang Lu, Christian Dollfus, Thomas Wozniak, Matthes Fleck
IKM, HSLU-W: Your Partner for Data

<https://www.hslu.ch/de-ch/wirtschaft/institute/ikm/>



Outline

01 Introduction

Who is IKM, HSLU-W? What are the strengths of the institute?
Who is MyCareerGate and x28? What is this project all about?

02 Galaxy of New Perspective

Employers are inter-connected considering their similarities in culture values forming anisotropic networks.

03 Patterns behind Big Data

Highly interesting underlying patterns can be identified from information of employers and candidates thanks to Big Data.

04 From Correlation to Match

Correlations of employers and candidates built upon their culture values lay a solid foundation for the match between the two.



Outline

05 Culture Recommender

Culture recommender systems must be established to boost the match of digital employer and candidate journeys.

06 AI-Enabled Job Predictor

Culture recommender-assisted intelligent job predictor is ready to influence the job opening time on labor market.

07 Summary & Outlook

The lessons that are learned from analyzing MyCareerGate and x28 data are truly valuable to other business applications.

08 Final Words

Magic is not magic: Modern data science and engineering tools are the key to the success of this Big Data project.

Who We Are

Institutes of Business School

Institute of Communication and Marketing IKM
Institute of Business and Regional Economics IBR
Institute of Financial Services Zug IFZ
Institute of Tourism ITW

CMT Mission

Applied R&D in business communication
and marketing utilizing Big Data technology
Knowledge upgrade and transfer amongst
research, education and business practice



Departments of Hochschule Luzern

Engineering and Architecture
Business
Information Technology
Social Work
Art and Design
Music

Competence Centers of Institute

Business Communication BC
Communication Management CM
Communication & Marketing Technologies CMT
Marketing Management MM

Data Science & Engineering Team

A young dynamic team aiming to
integrating modern data science
and engineering technologies into
the strengths of IKM, HSLU-W

Data Science & Engineering Team



Dr. Matthes Fleck

Head of IKM, HSLU-W

Leading researcher in the field of entrepreneurship and mentor for startups around the globe



Dr. Thomas Wozniak

Head of Research, IKM

Outstanding researcher at science-based innovations particularly in the area of marketing & communication



Dr. Christian Dollfus

Lecturer Data Engineering

Extensive industry experience in enterprise startups with full knowledge of modern data engineering



Dr. Guang Lu

Lecturer Data Science

Strong expertise in data science technologies and passionate about interesting business applications



Our Industry Partners

MyCareerGate

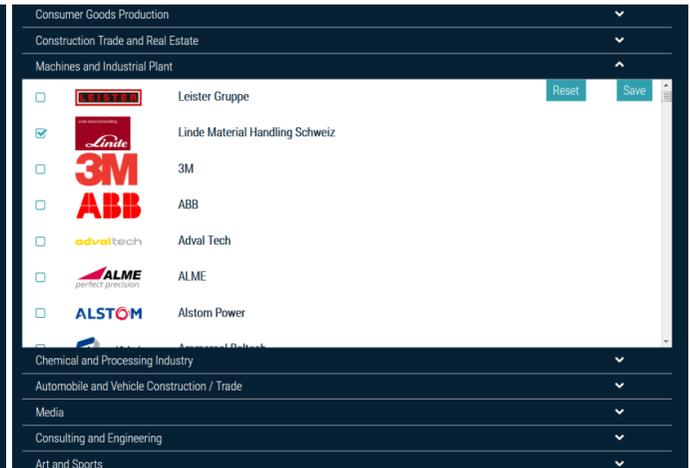
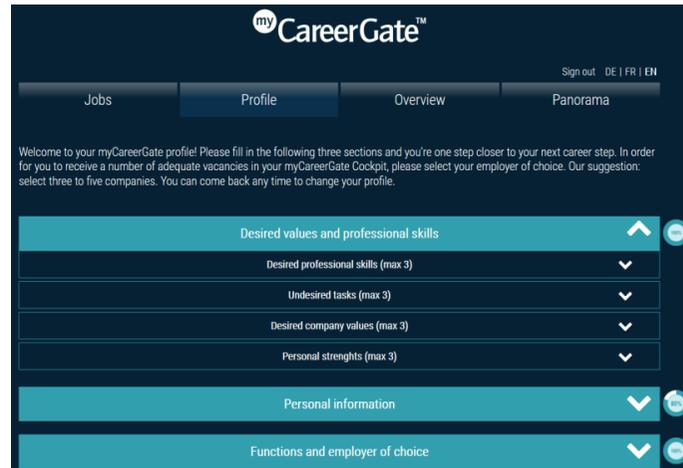
An intelligent portal for job agencies and companies to find needed talents on the labor market and to perform active sourcing of job seeking candidates



x28

A highly innovative company in HR technology providing smart tools for labor market and feeding MyCareerGate with actualized comprehensive job data in Switzerland on a daily basis

Jobseekers can fill up different fields in order to specify their future job preferences such as culture values and other important information



- Respect
- Transparency
- Sustainability
- Passion
- Courage
- Professionalism
- Team Work
- Fairness
- Simplicity
- Appreciation
- Result Focused
- Equality
- Diversity
- Mutability
- Customer Oriented
- Reliability
- Innovation
- Security
- Quality
- Confidence
- Goal-Oriented
- Make Additional Benefit
- Excellence
- Performance-Oriented
- Role Model

Würth
1 open positions

[Jobs](#) [More](#)

comparis.ch
3 open positions

[Jobs](#) [More](#)

ewp
Ingenieure | Planer | Geometer
1 open positions

[Jobs](#) [More](#)

CERN
7 open positions

[Jobs](#)

CSS Kranken-Versicherung
11 open positions

[Jobs](#)

Cisco
6 open positions

[Jobs](#)

Database Engineer (IT-DB-DBR-2019-118-LD)

Linux Kernel Software Developer (BE-CO-HT-2019-112-LD)

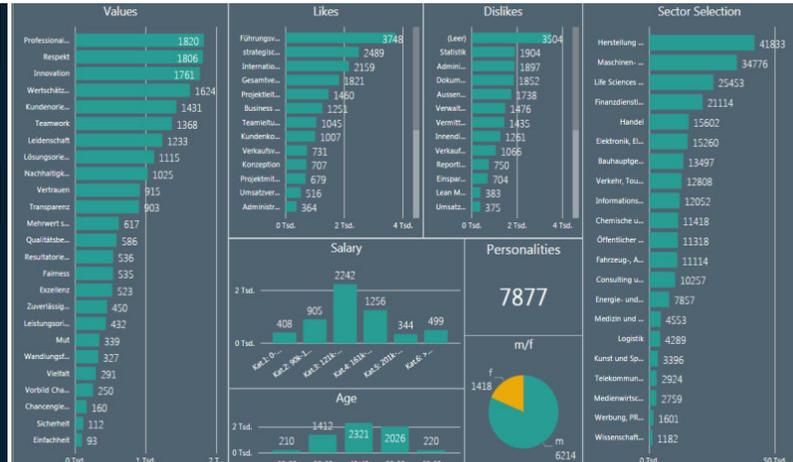
Configuration Manager (EN-ACE-CL-2019-111-LD)

Robotics Engineer (EN-SMM-MRO-2019-117-LD)

Building and Infrastructure Project Manager (SMB-SE-2019-119-LD)

Software Engineer (ITCF-SM-2019-121-LD)

Digital Electronics and Firmware Engineer (BE-RF-CS-2019-122-LD)



- ✓ Candidates can select their interested employers
- ✓ Candidates can enter the desired preferences e.g. employer location, liked/un-liked functions, culture values to formulate a profile
- ✓ Candidates get a list of all opening jobs based on the creation of their profiles
- ✓ The candidate profiles are sorted and mapped to the opening labor market jobs

IKM

Data Science Project

SCOPE OF THE PROJECT

This project develops an Artificial Intelligence-driven engine for the job/candidate portal MyCareerGate in order to enhance the employer-candidate matching process leveraging their culture values.

The project is undertaken by IKM, HSLU-W within a three-month time period.

Strong Industry Partner

MyCareerGate has in total collected ~2000 employers and ~8000 candidates data since 2016 and resolves to enhance the digital employer and candidate journey on labor market. **x28** has a complete and actual set of all opening jobs in Switzerland providing also sophisticated analytical and digital solutions for the HR technology.

Ambitious Business Goal

This project aims to enhance branding Less Well-Known Enterprises (**LWES**) by speeding up their finding of the potentially matching candidates who are having culture preferences that are aligning with their own.

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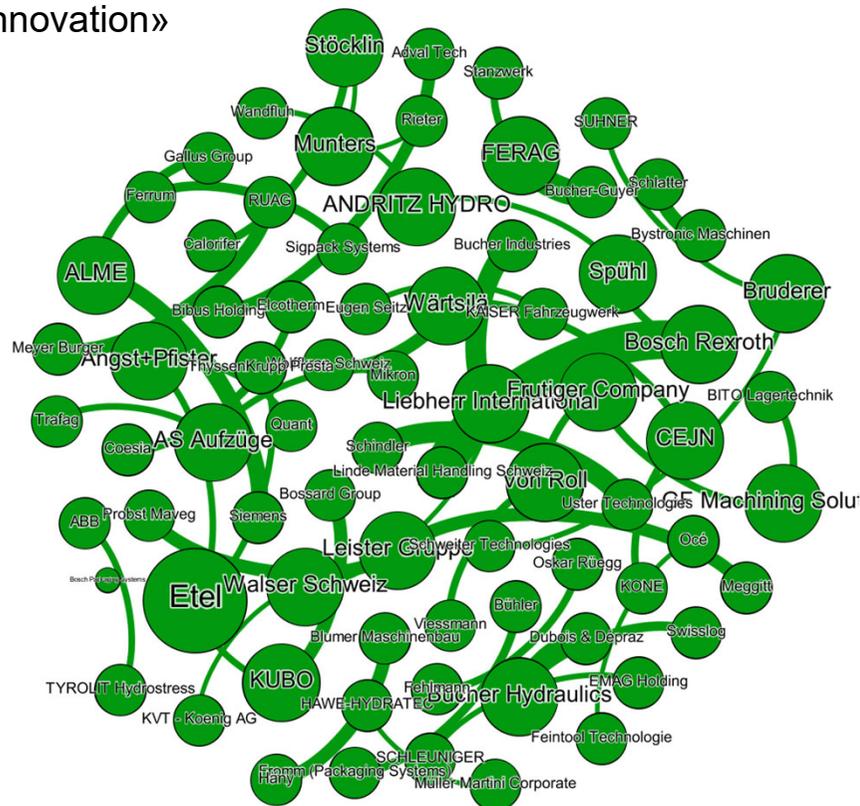
Galaxy of New Perspective

Network of employers viewed from culture

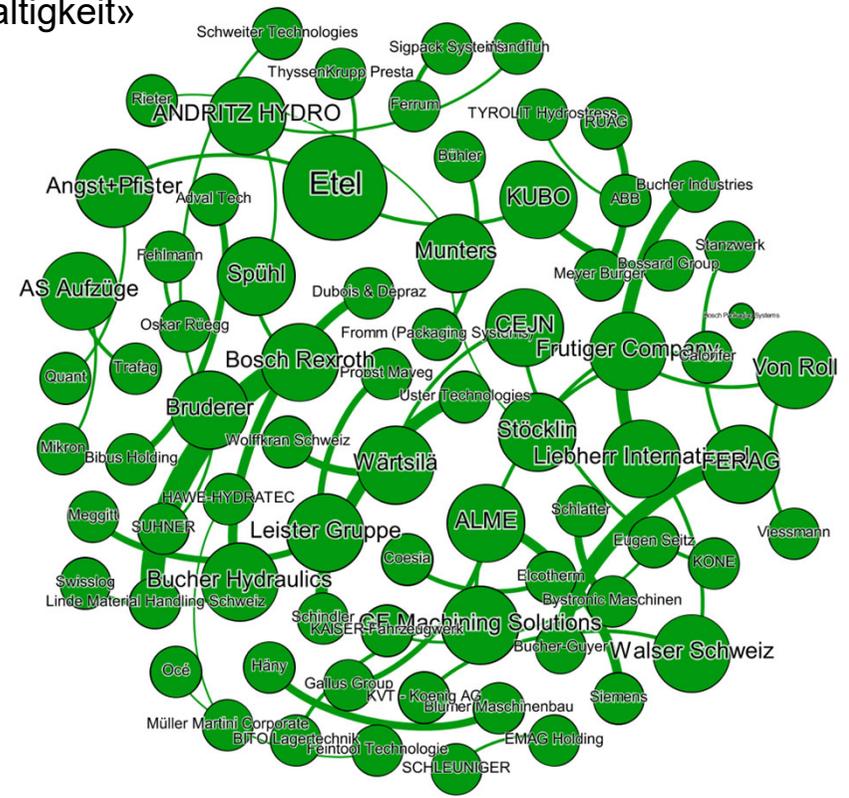
Culture Structure within Sector

Randomly selected 50 employers within the “Maschinen- und Anlagenbau” sector exhibit different culture structures for the two evaluated values
 Node size: Potential amount of candidates for this employer; Line thickness: Lineally proportional to the culture similarity between the two connected employers

«Innovation»



«Nachhaltigkeit»



Patterns behind Big Data

CANDIDATE

- What is the candidate age over the sectors?
- Is there a difference in the expected salary for given industry sectors?

EMPLOYER

- Can we estimate the industry sector size?
- Can we evaluate the culture characteristics for any industry sector?

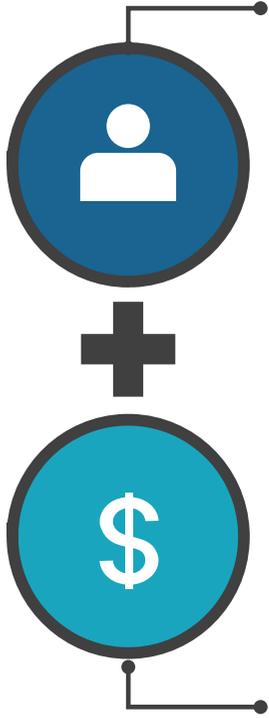
CULTURE

- How are the culture values rated in and among the sectors?
- What are highly rated values by candidates?

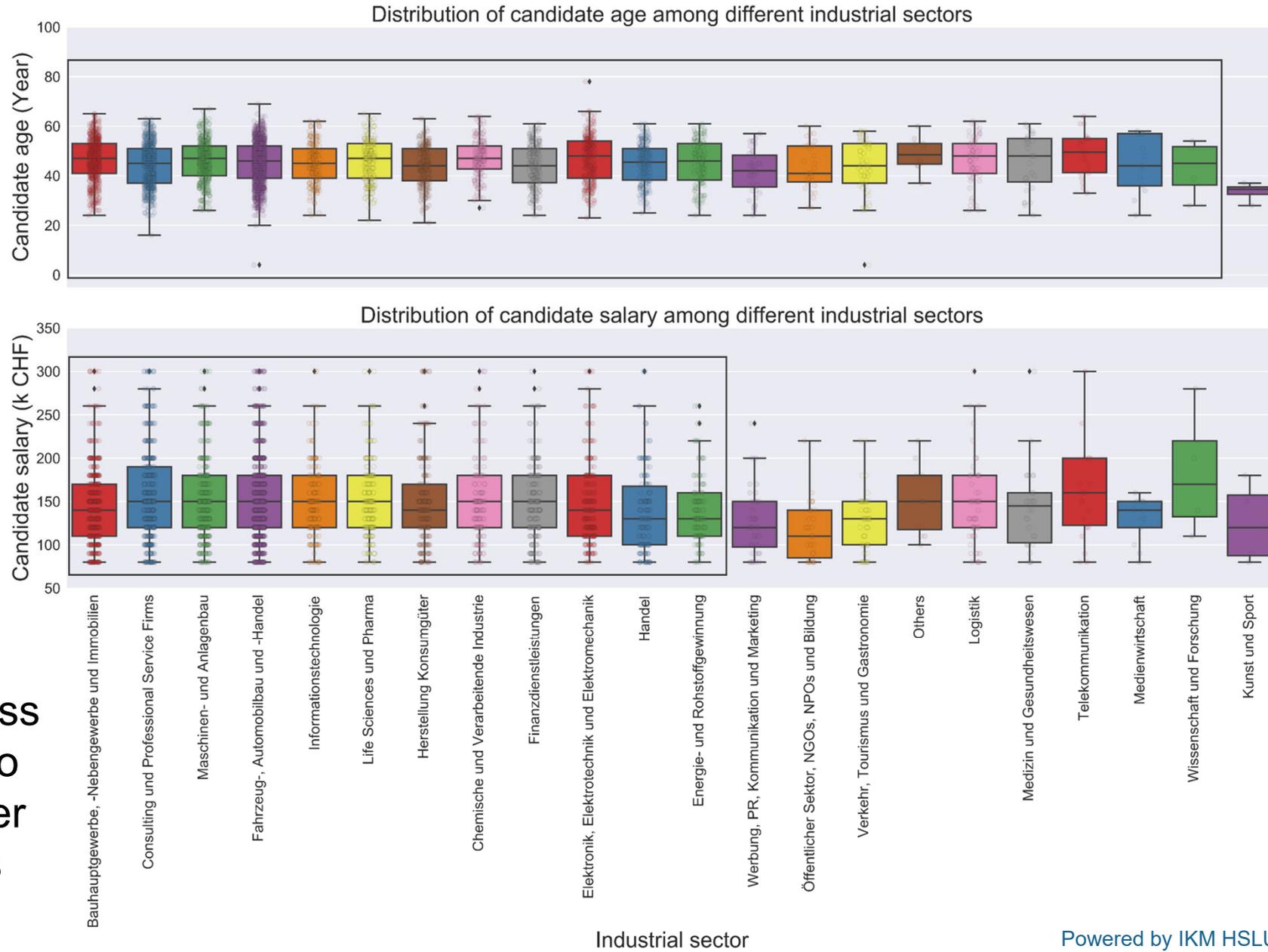
JOB

- How are the wished work places distributed geographically?
- How large is the pool of candidates region-wise?

Salary + Age

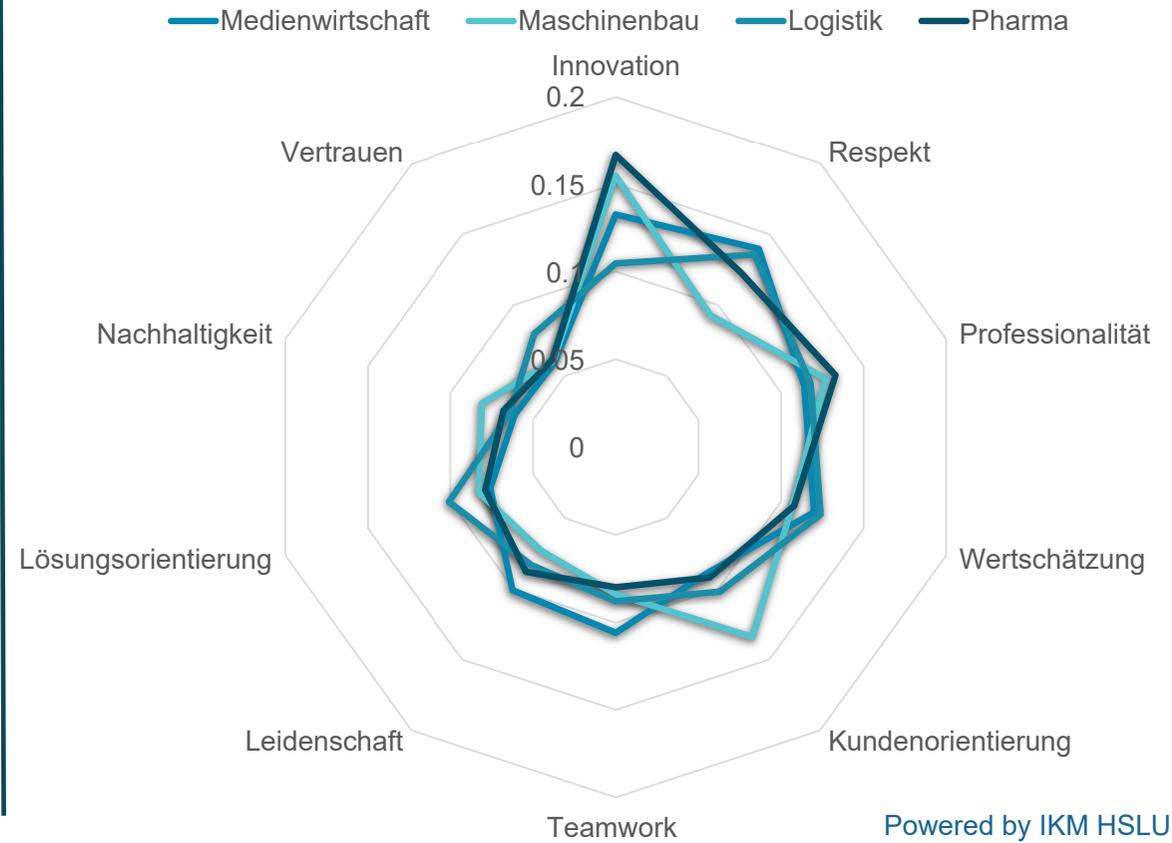
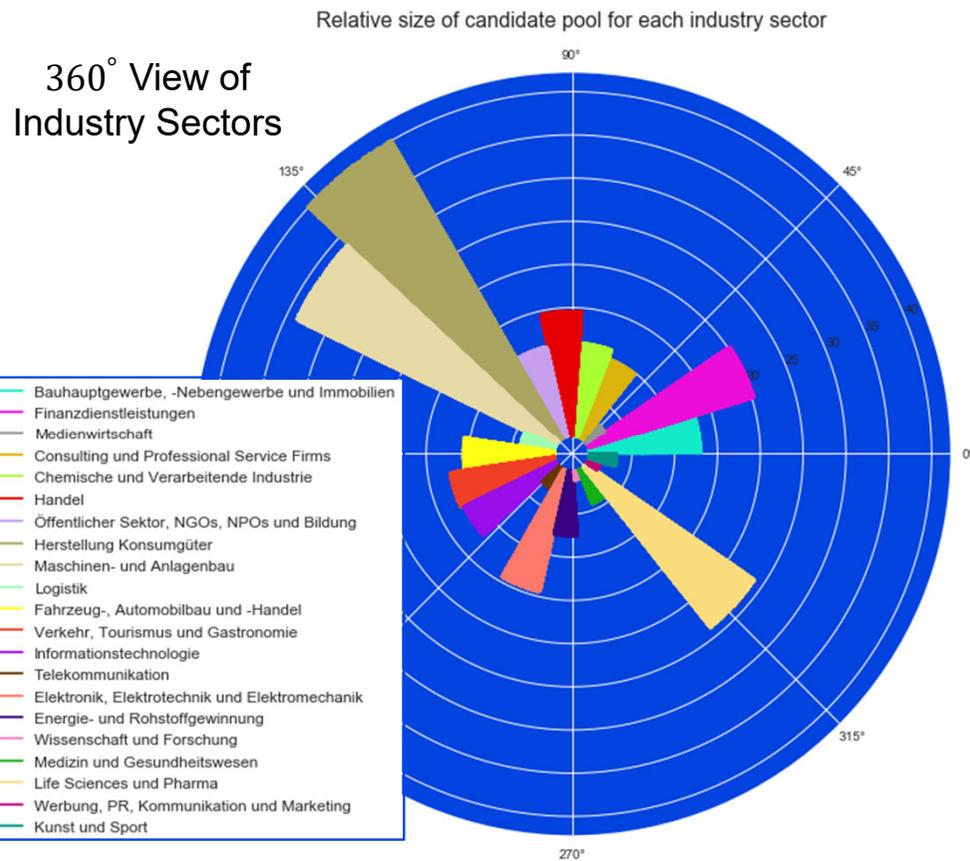


Candidate age is less varying compared to expected salary over the industry sectors

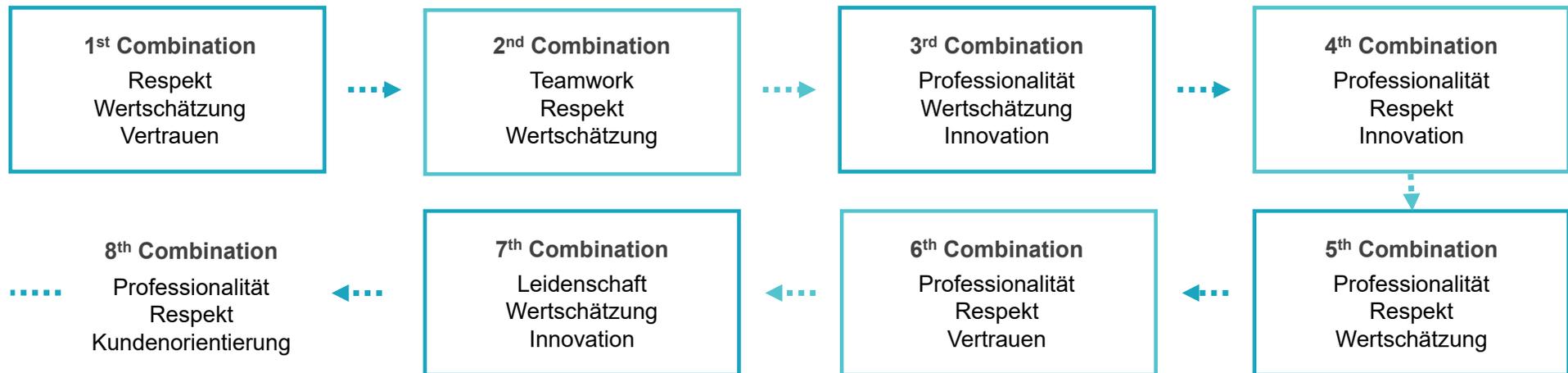
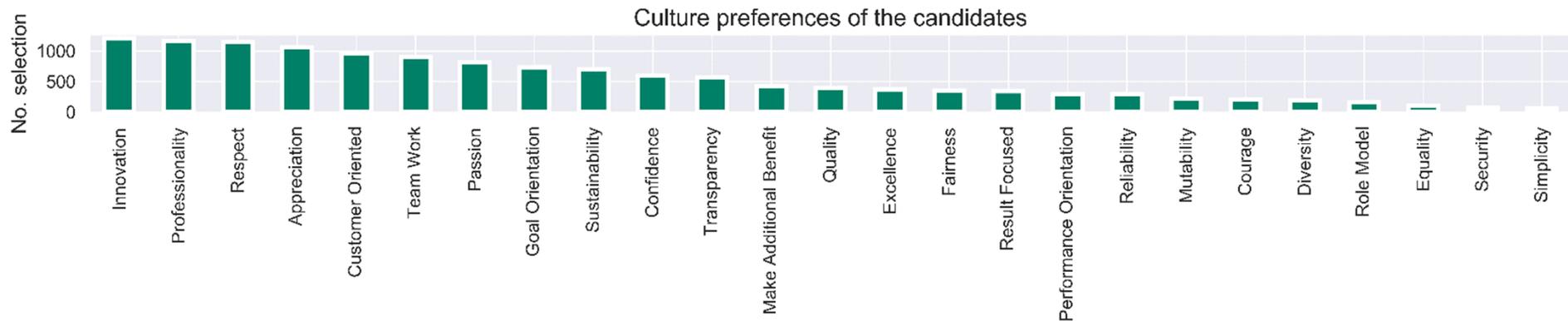


Sector Size and Culture Values

Sector sizes estimated from the number of potential candidates exhibit anisotropic characteristics
 Culture values for industry sectors also show differences from one to another according to the view of candidates



Mostly Selected Culture Values



Distribution of Wished Work Place



01 Continent Level

40% of recorded candidates on MyCareerGate prefer to work in Europe.

02 Country Level

Close to 50% of recorded candidates in DACH countries prefer to work in Switzerland.

03 Region Level

About 35% of recorded candidates in Switzerland prefer to work around the Zurich region.

04 Job Level

So far the granular information of opening jobs has been thoroughly collected in Switzerland.

99.99%

\$0.01



Powerful Recommender

Enhanced digital employer and candidate journey starts from our Culture Recommender.

Culture Correlation

Correlation analysis shows that certain culture value combinations are preferred by candidates.

Employer Clustering

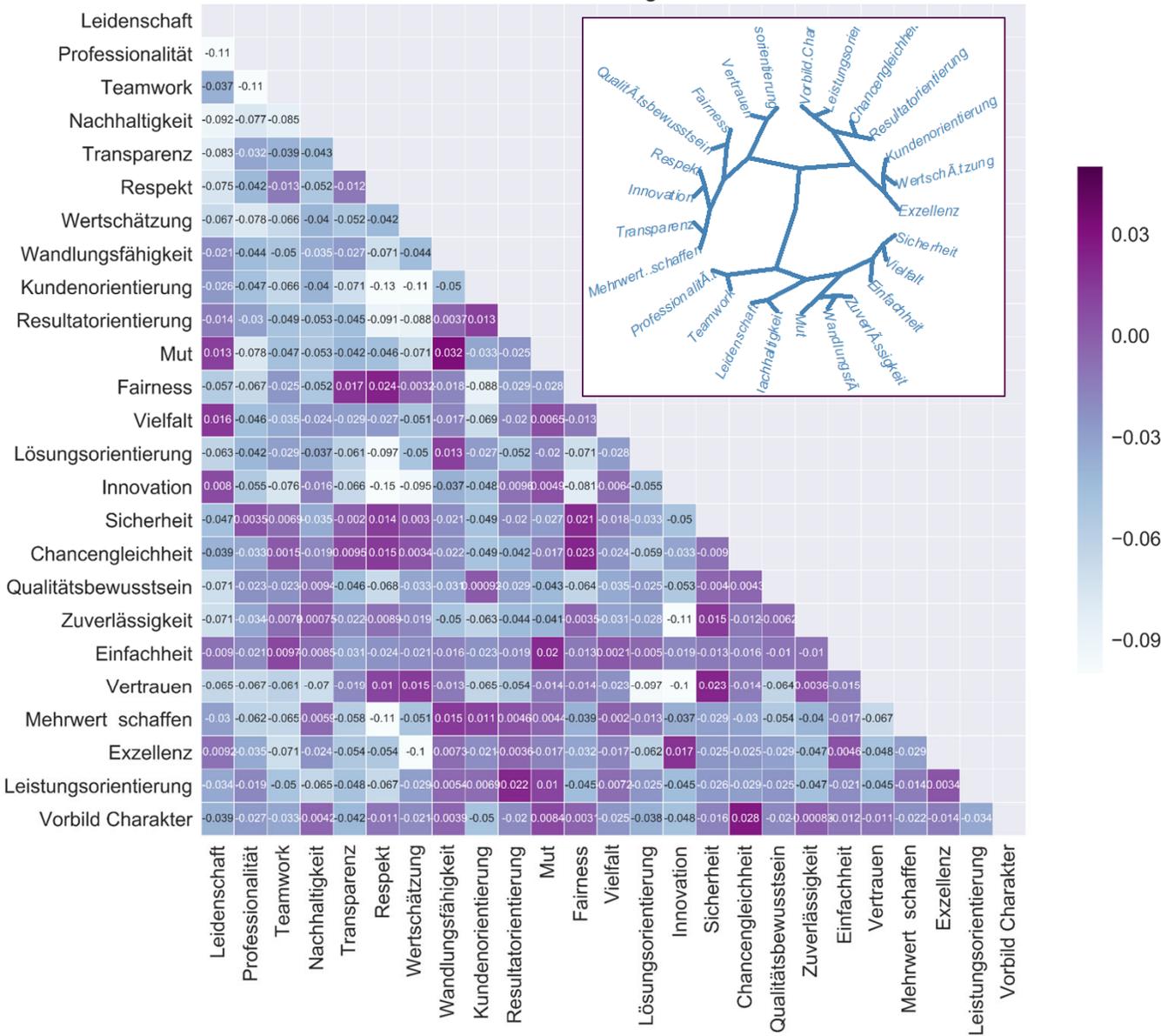
Employers can be clustered into groups using their culture values claimed by candidates.

Culture Recommender

Our culture recommender employing the potential culture matching between employers and candidates reveals the "Hidden Champions" for candidates.

**From Correlation to Match
Culture Recommender**

Correlation culture rating over candidates



“

The correlation of culture values based on the candidates' selection exhibits certain trend of positive and negative interactions between the culture values.

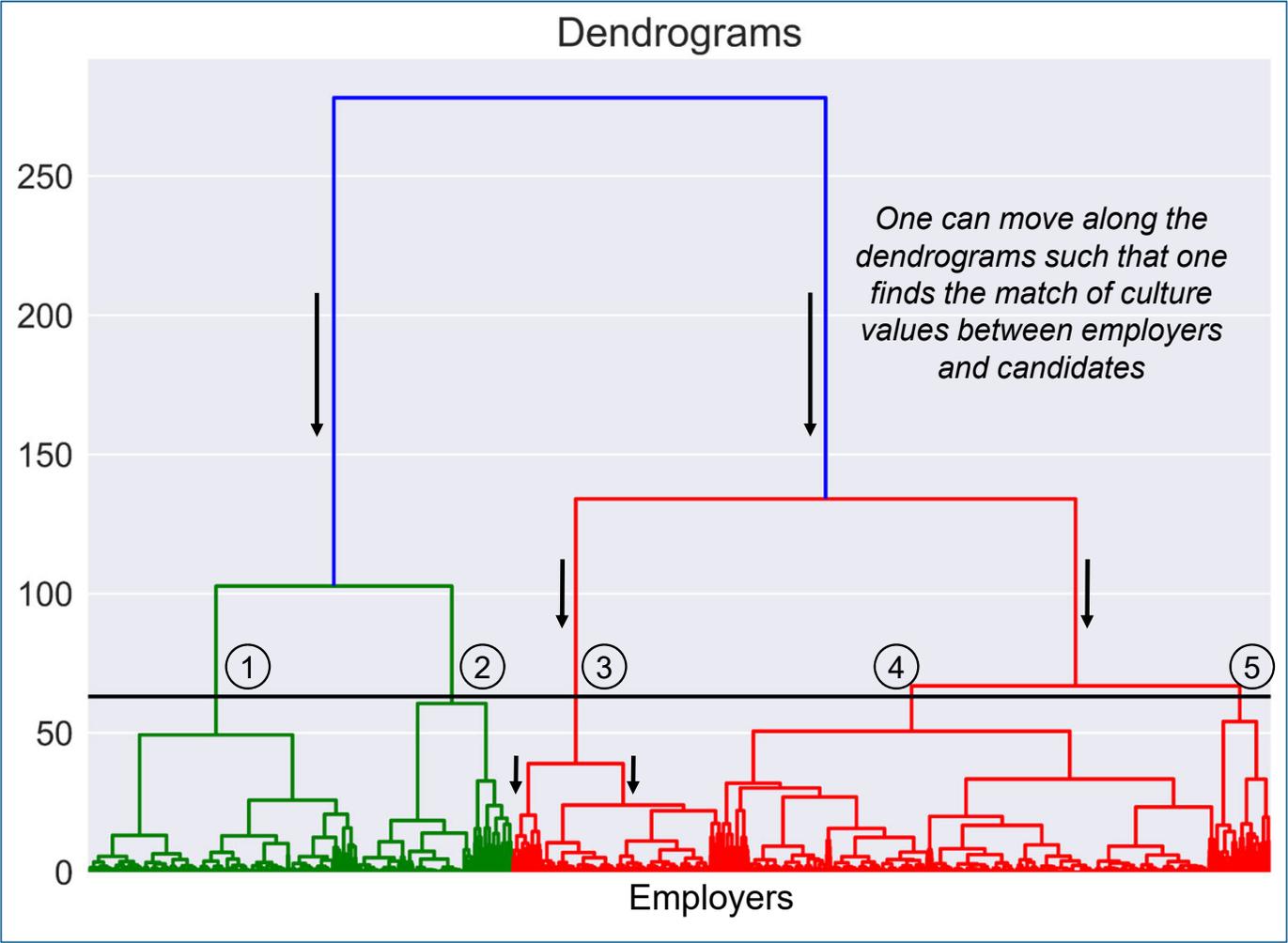
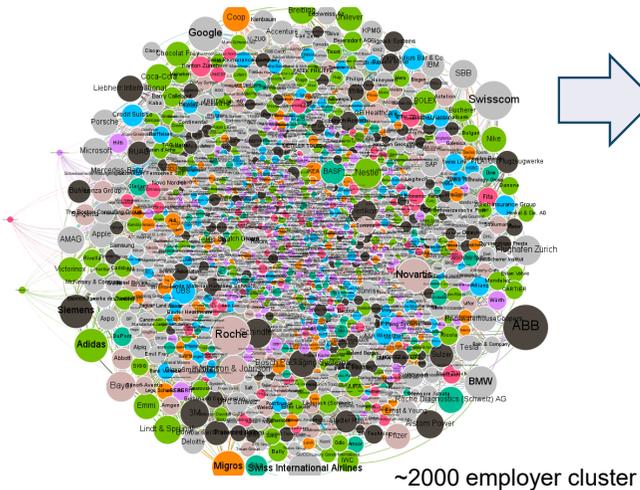
For example, “Wandlungsfähigkeit” and “Mut” are positively correlated, which is kind of reasonable. However, “Innovation” and “Respekt” are negatively correlated. These observations show from the candidates' perspectives how they tend to explain and select the culture value combinations.

”

Culture Correlation

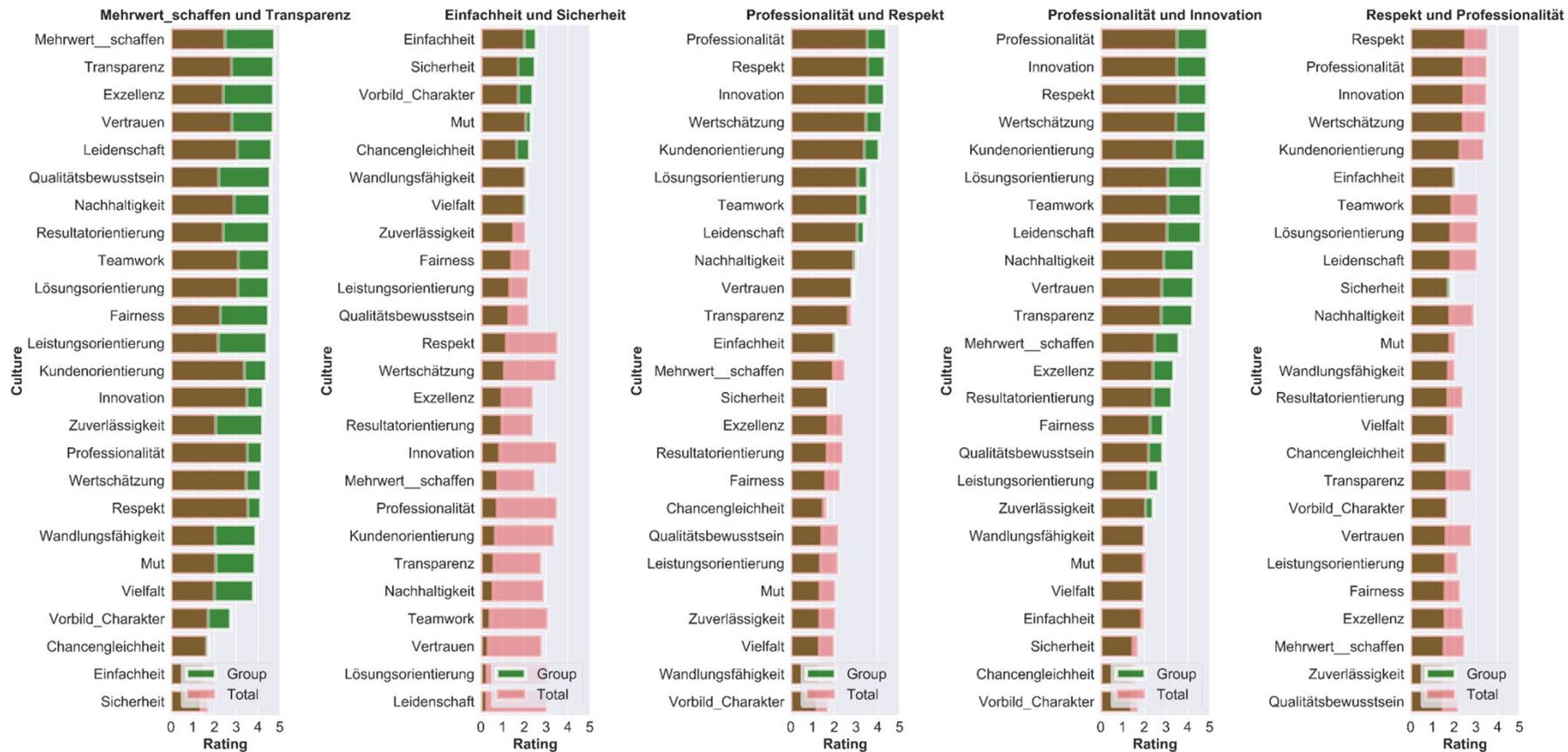
Employer Clustering

BASED ON THEIR CULTURE VALUES

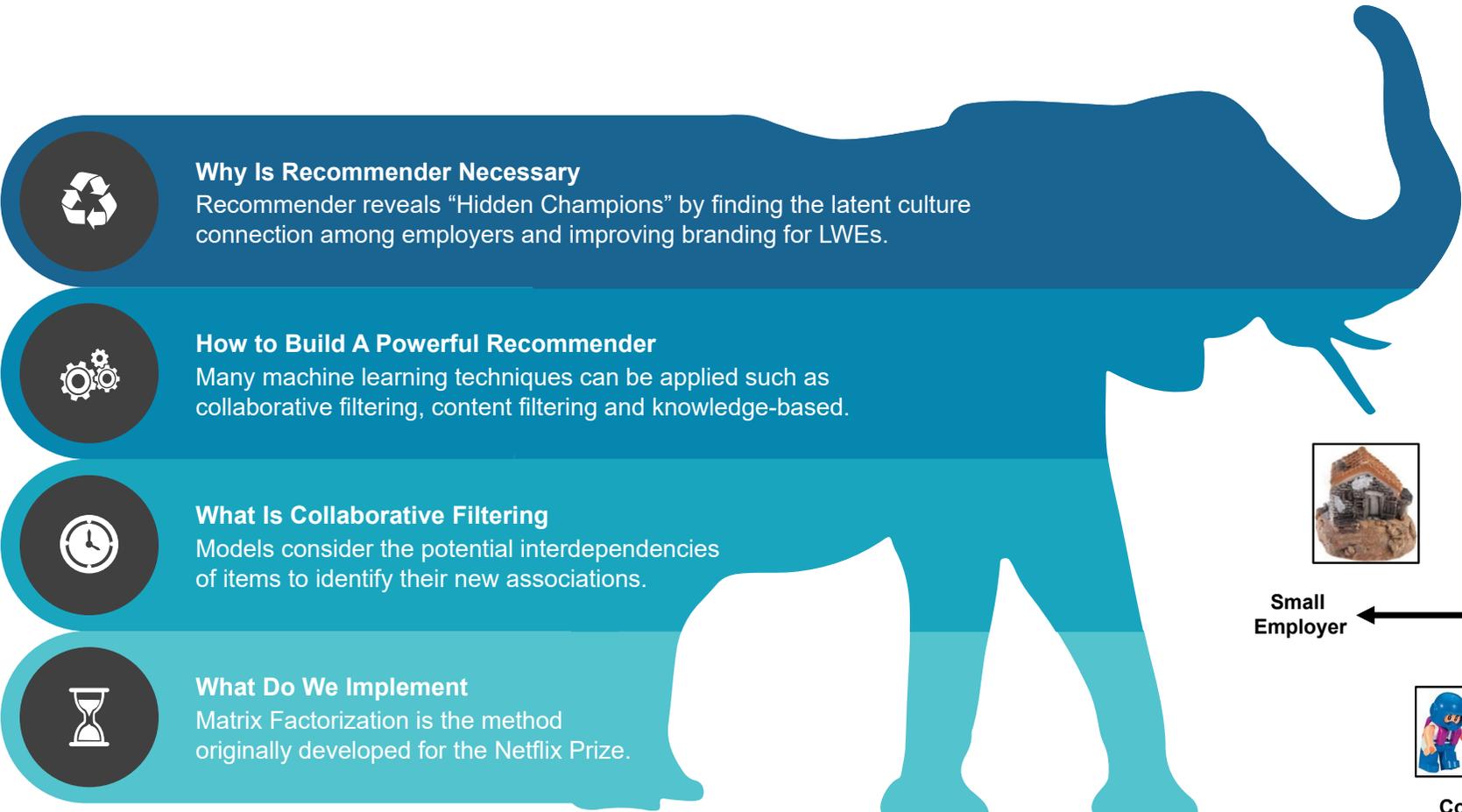


Culture Group Formed by Employer

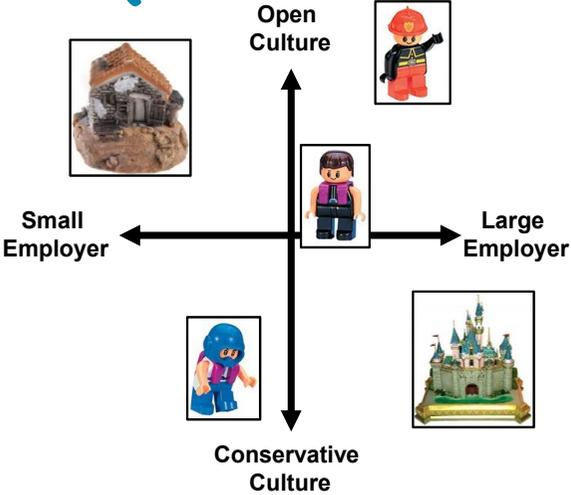
Employers are clustered into e.g. 5 groups according to their culture values
 Each group of employers is marked by their unique culture values such that a match to the candidates' preferences is feasible



Building Powerful Recommenders



- **Why Is Recommender Necessary**
Recommender reveals “Hidden Champions” by finding the latent culture connection among employers and improving branding for LWEs.
- **How to Build A Powerful Recommender**
Many machine learning techniques can be applied such as collaborative filtering, content filtering and knowledge-based.
- **What Is Collaborative Filtering**
Models consider the potential interdependencies of items to identify their new associations.
- **What Do We Implement**
Matrix Factorization is the method originally developed for the Netflix Prize.



Y. Koren, R. Bell and C. Volinsky, 2009. Matrix Factorization Techniques for Recommender Systems. *Computer* 42: 30-37.

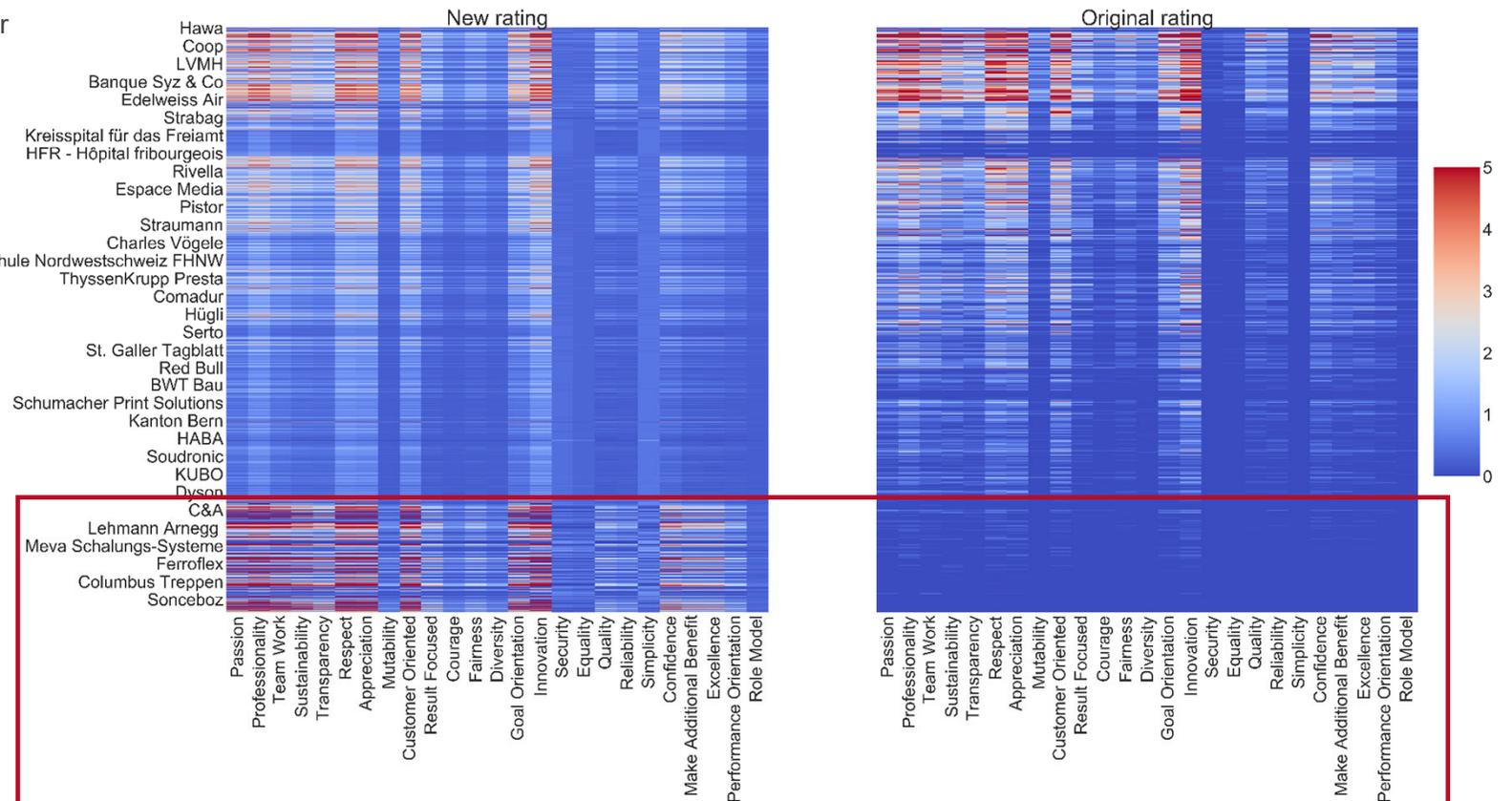
Matrix Factorization Based Recommender

Computational Steps

The principles of user-movie recommender systems for the Netflix Prize competition have been implemented. A rating matrix has been constructed with employer names as rows and culture values as columns in order to implement the Matrix Factorization.

- ✓ The size of the rating matrix is 1996 (employer) times 25 (culture value) resulting in 49900 elements.
- ✓ Each element is given a value counting the number of selections provided by candidates to that employer-value pair.
- ✓ Elements smaller than 5 (median value) are set to a rating 0 (i.e. unknown rating) while elements larger than 104 (105-5=100) are set to a rating 5.
- ✓ The other element values are linearly scaled between the ratings 0 and 5 according to a step size of 0.1.

Comparison of ratings for the employer-value pairs



AI-Enabled Job Predictor

Computational intelligence brings LWEs to the front of the stage through enhanced branding of their culture values. Potentially this is valuable to filling labor gaps on market.

This analysis is based on the data from x28

01

How Many Jobs Recorded

Close to 190'000 opening jobs have been recorded by MyCareerGate.

02

What Do We Know

We know job opening time, sector, company, function, language, location, etc.

03

What Can We Do

We build a predictor for the job opening time using employer popularity and culture values.

04

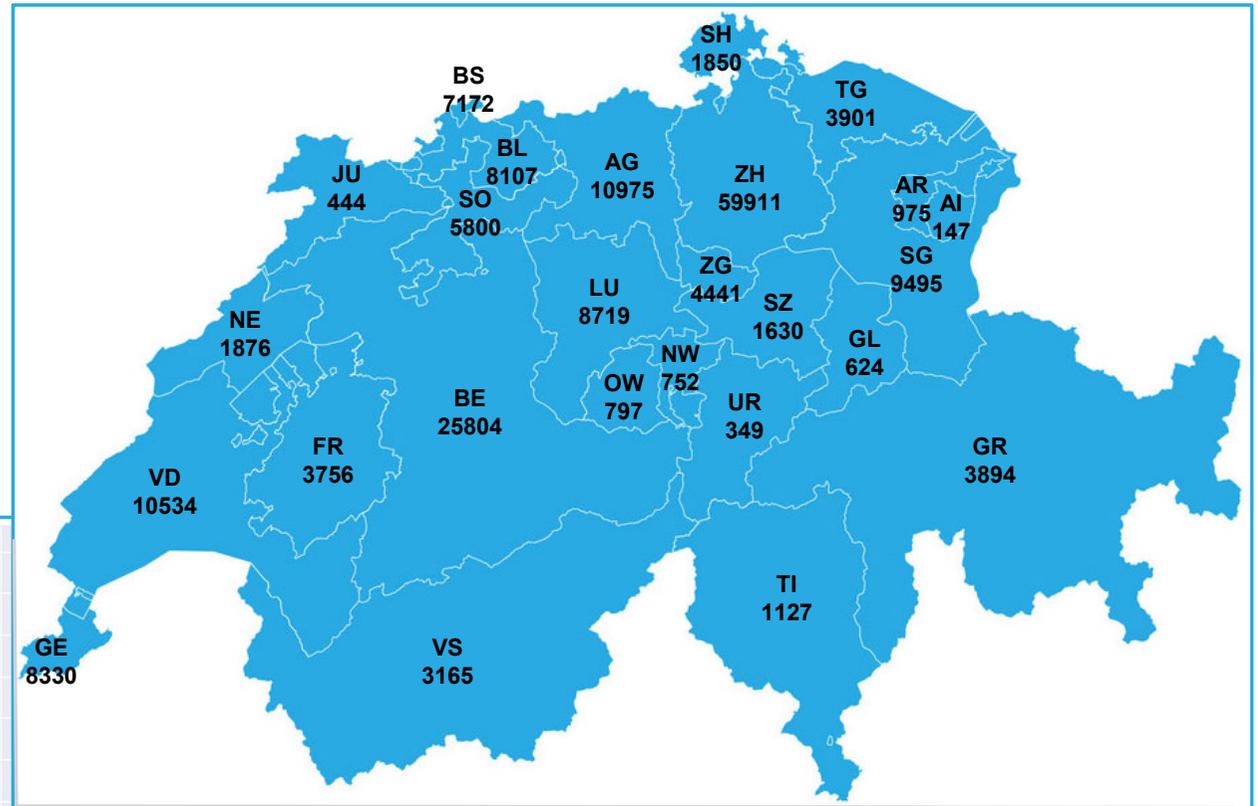
What We Achieve

The predicted job opening time is generally shorter than reality for LWEs with enhanced culture branding.

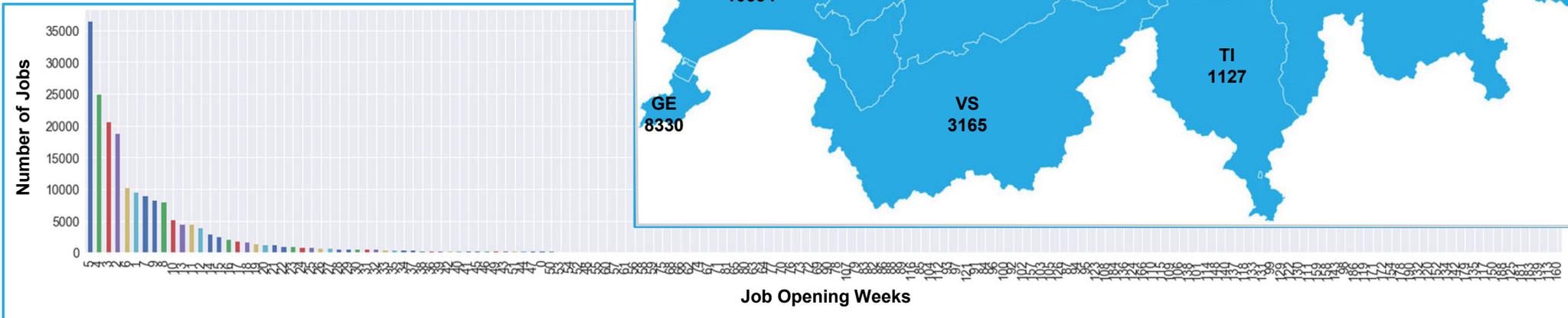


Time and Space Distribution of Jobs

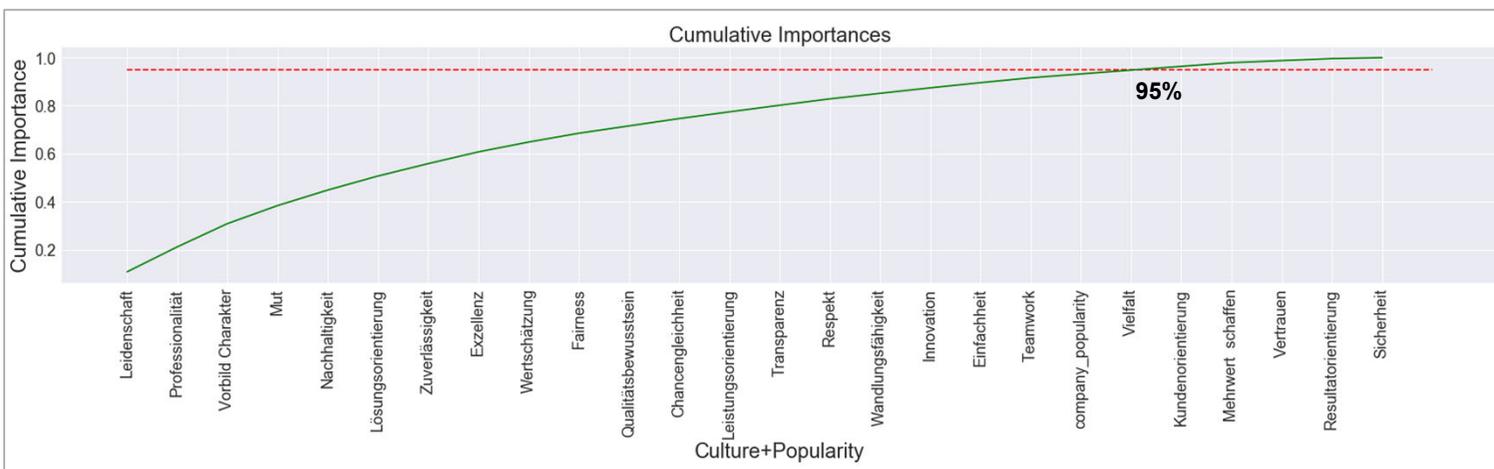
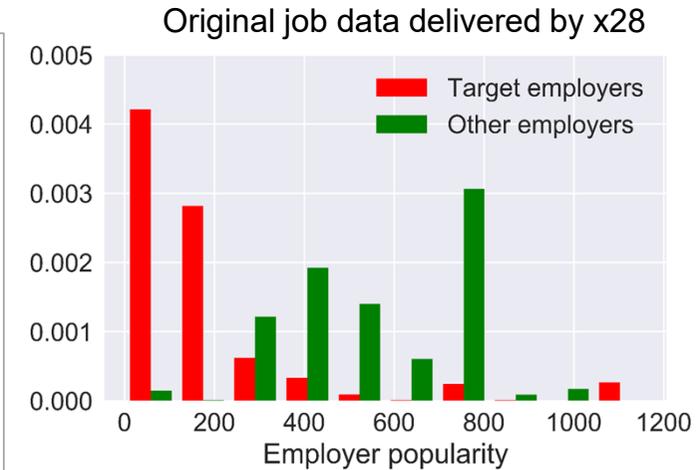
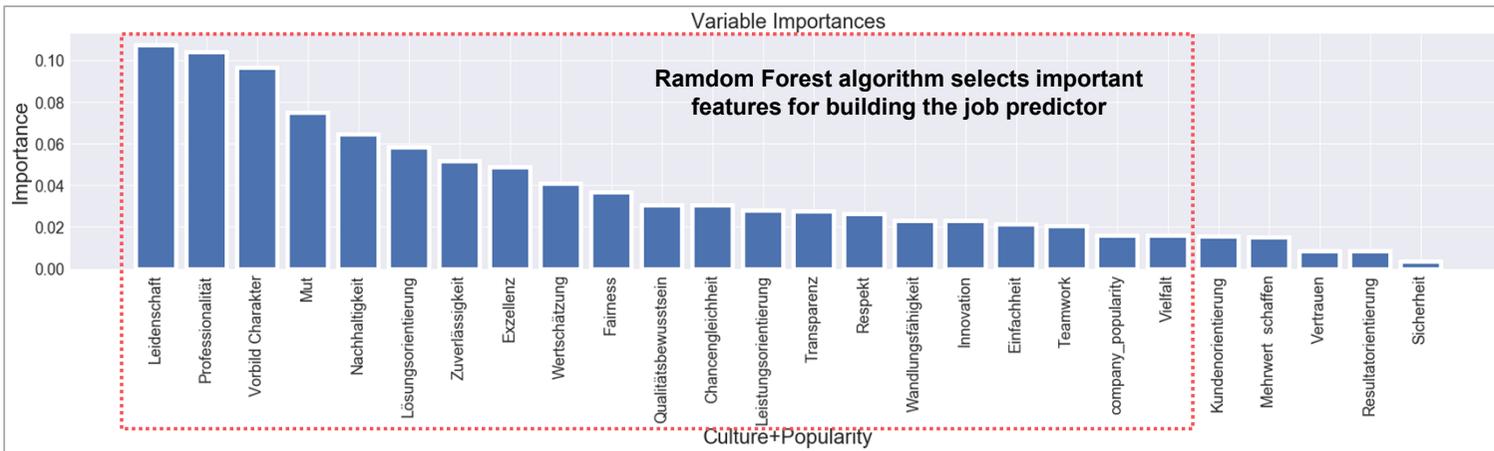
- Time** ➤ Most of the jobs stay open within a 0.5 year period. Very few jobs remain open for a very long time (> 1 year).
- Space** ➤ Job opportunities concentrate at Zurich, Bern, Basel, Basel, Aargau, Vaud, St. Gallen, Luzern, Geneva, etc.
- Feature** ➤ The Swiss labor market exhibits a non-uniform time and space distribution for the opening jobs.



Original job data delivered by x28



Smart Predictor for Job Opening Time



- The predicted ~175 k jobs opening time in combination of our culture recommender is in average **~0.16 months shorter than reality**
- Employer popularity is evaluated using the number of candidates for that employer
- Target employers (e.g. LWEs): The predicted job opening time is shorter than the actual time
- Other employers (e.g. well-known enterprises): The predicted job opening time is comparable to the actual time

Summary & Outlook

What We Have Done & Learned

This project has concentrated on a concrete business case – MyCareerGate. We have created a novel business-supporting model by leveraging the culture values of both employers and candidates in order to enhance the matching of the two. Hence the job opening time can be also potentially shortened considering that employers can find the ideal candidates more quickly. The implementation of modern Data Science technologies has demonstrated to us that computational intelligence is extremely important to the success of business in this fast digital world.

Very importantly, the entire project pipeline can be applied for other data-orientated projects and can hopefully generate more values to enterprises and customers.

Key Findings And “Giveaways”

01
Using an AI-based system, employers can be recommended to the candidates having similar value preferences.



03
A similarity map of employers can be established using selected values, i.e. those employers are comparable from the viewpoint of candidates.



05
According to labor market prediction, LWEs will have shorter job opening time with right employer branding.



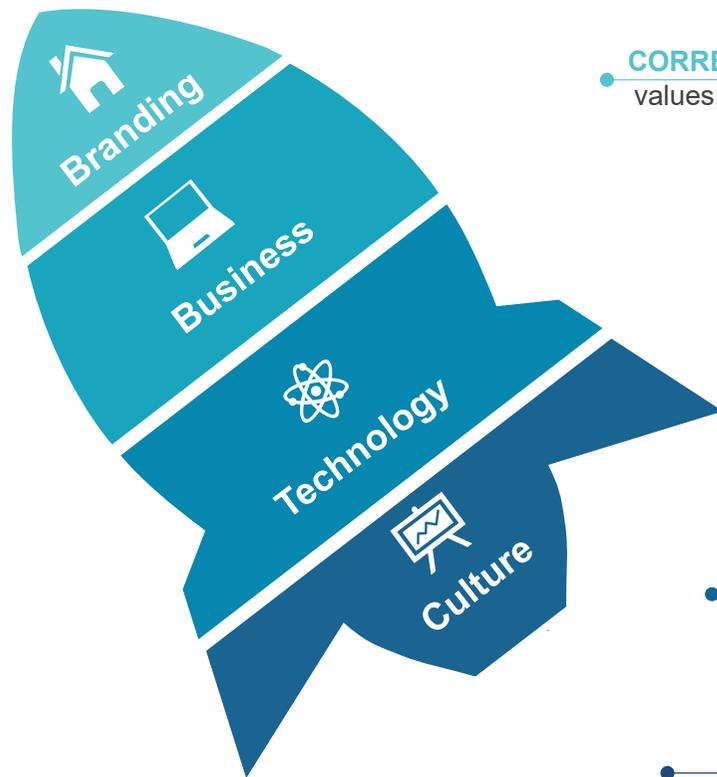
02
Individual employer can be clustered into different groups according to the employer branding of their culture values.



04
The values “sustainability” and “trust” are not seen as very important in the view of candidates in contrast to “innovation” and “professionality”.



New Data Science Toolset at IKM



• **EMPLOYER VALUE CLUSTER** Established a grouping/clustering mechanism to join similar employers regarding specific culture values in order to prepare for culture recommender systems



• **CORRELATION FINDER** Toolset to compare and rank the preferences of the candidates in e.g. values, salaries and functions regarding different jobs, sectors, locations and employers in order to correlate them for an optimized employer branding



• **CANDIDATE VALUE CLUSTER** A new matching tool between candidates and employers has been established based on their culture values



• **EMPLOYER BRANDING** Employer branding tool has been developed based on the perception of candidates for different sectors and employers regarding the selected culture values



• **RECOMMENDER ALGORITHM** Algorithm that performs recommendations to the candidates based on selectable attributes i.e. "Netflix-style" recommendation of employers to candidates



• **LABORMARKET PREDICTOR** Algorithm predicting the future job opening time indicates the right market trends within sectors and employers





Data Engineering
tools are used to extract, transform and load (ETL) Big Data for analytics.



Data Science
tools are used to identify hidden patterns and build predictive models.



Data Visualization
tools are used to visualize and animate interesting findings from data.

Final Words

The Computational Intelligence Tools



Tools for Big Data Technology



Python

Python is the most popular programming language for applied data science. The supporting tools such as scikit-learn, TensorFlow and Keras make Python a perfect environment for data modelling and learning.



Pentaho

Pentaho is a powerful, “drag-and-drop” Business Intelligence software which supplies many data integration (ETL: extract, transform, load), data mining and data reporting solutions. Mainly the Pentaho Data Integration part of the whole Pentaho BI-Suite was used in this project.



Neo4j

Neo4j is the most welcome Graphic Database. It is able to conveniently handle big network data. Leveraging three.js via 3d-force-graph one can render 3d graphs such as our employer galaxy.



Tableau

Tableau is an interactive, “drag-and-drop” data visualization and animation software developed for Business Intelligence. It is famous for its excellent performance in creating eye-catching graphs.



Gephi

Gephi is based on NetBeans platform and Java. It is open source and can particularly be used to analyze and visualize large networks.



THANK YOU

IKM, HSLU-W – Your Partner for Data

