Get everybody on board and get going

The automation of subject indexing at ZBW

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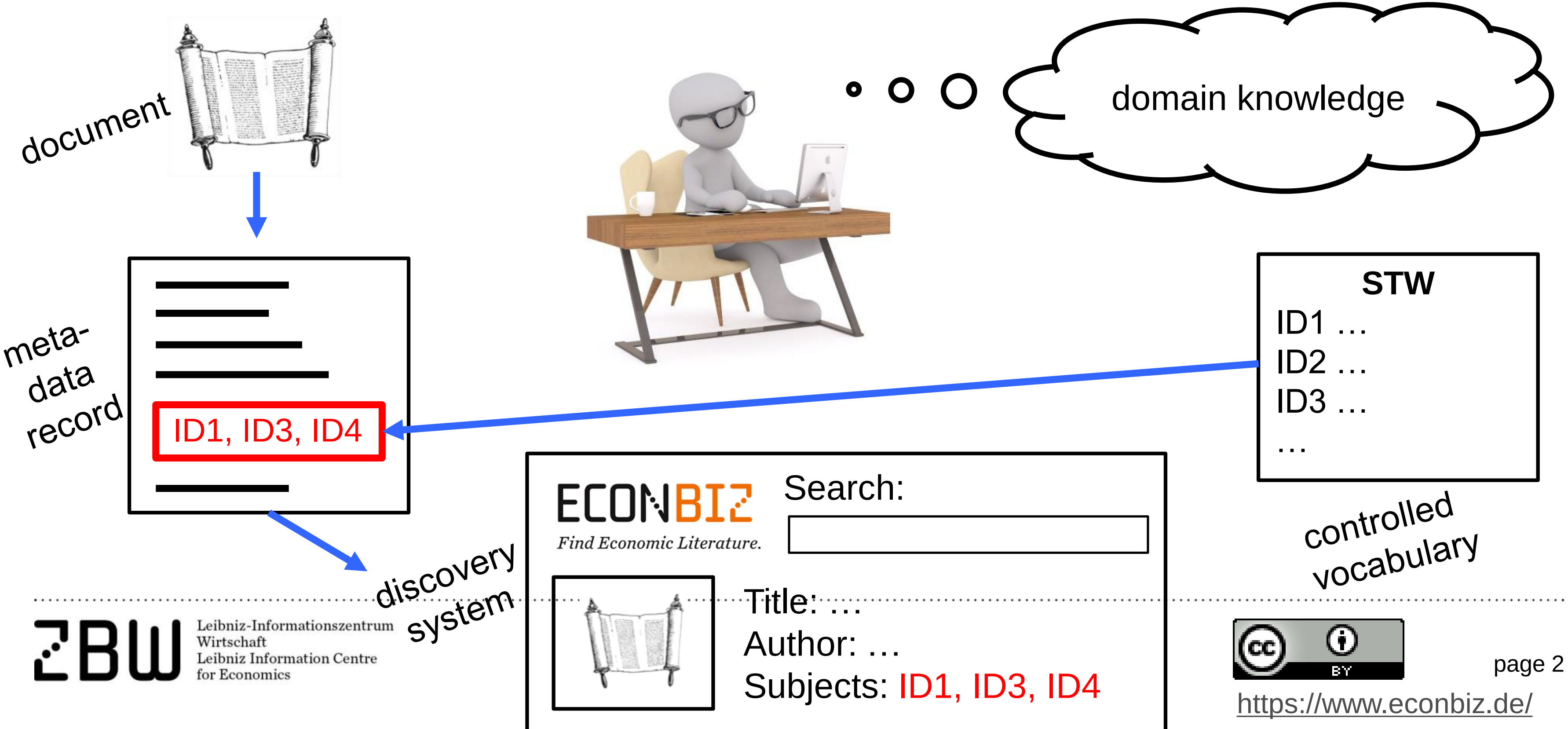
ZBW – Leibniz Information Centre for Economics
IFLA WLIC 2022 Satellite Conference on Artificial Intelligence, 21–22 July 2022, Galway, Ireland

Intellectual subject indexing at ZBW



http://zbw.eu/stw/versions/latest/about.en.html

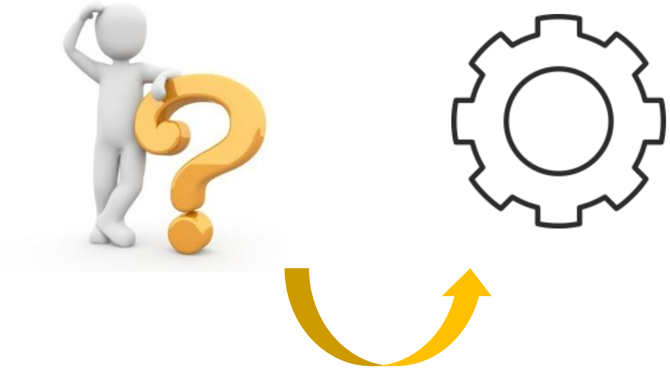
https://www.econbiz.de/

Why automate subject indexing? circumstances at ZBW:

- over 100.000 new resources per year

- ZBW indexes resources from economics with ZBW‘s own STW thesaurus and
- is often the first library to index a resource

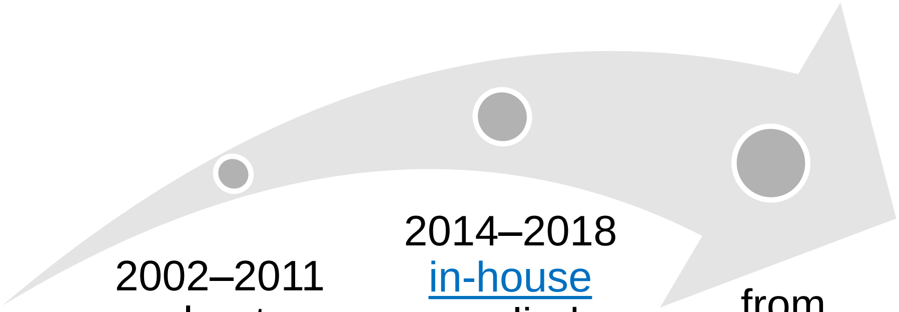
→ little reuse of metadata from our library union



- new and diverse tasks for subject librarians

→ ZBW currently has the capacity to index ~35.000 resources per year intellectually

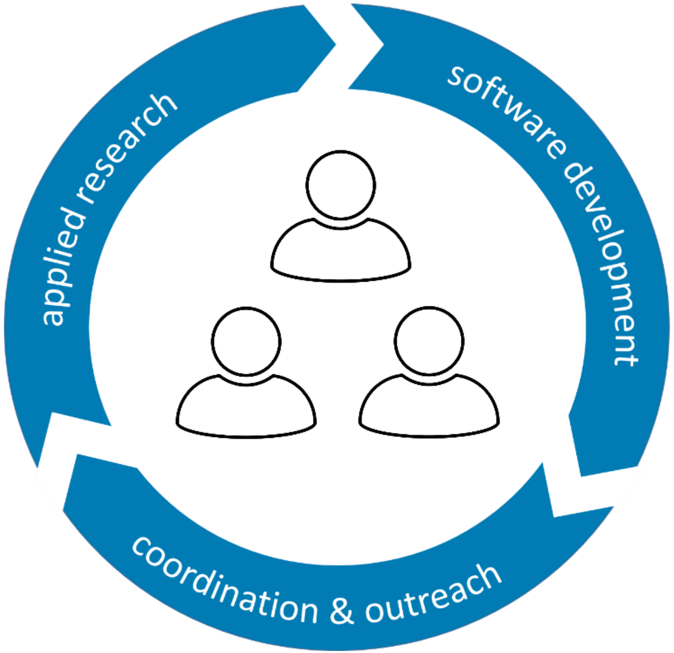
AutoSE: transferring applied research into a productive service



2002–2011 exploratory projects

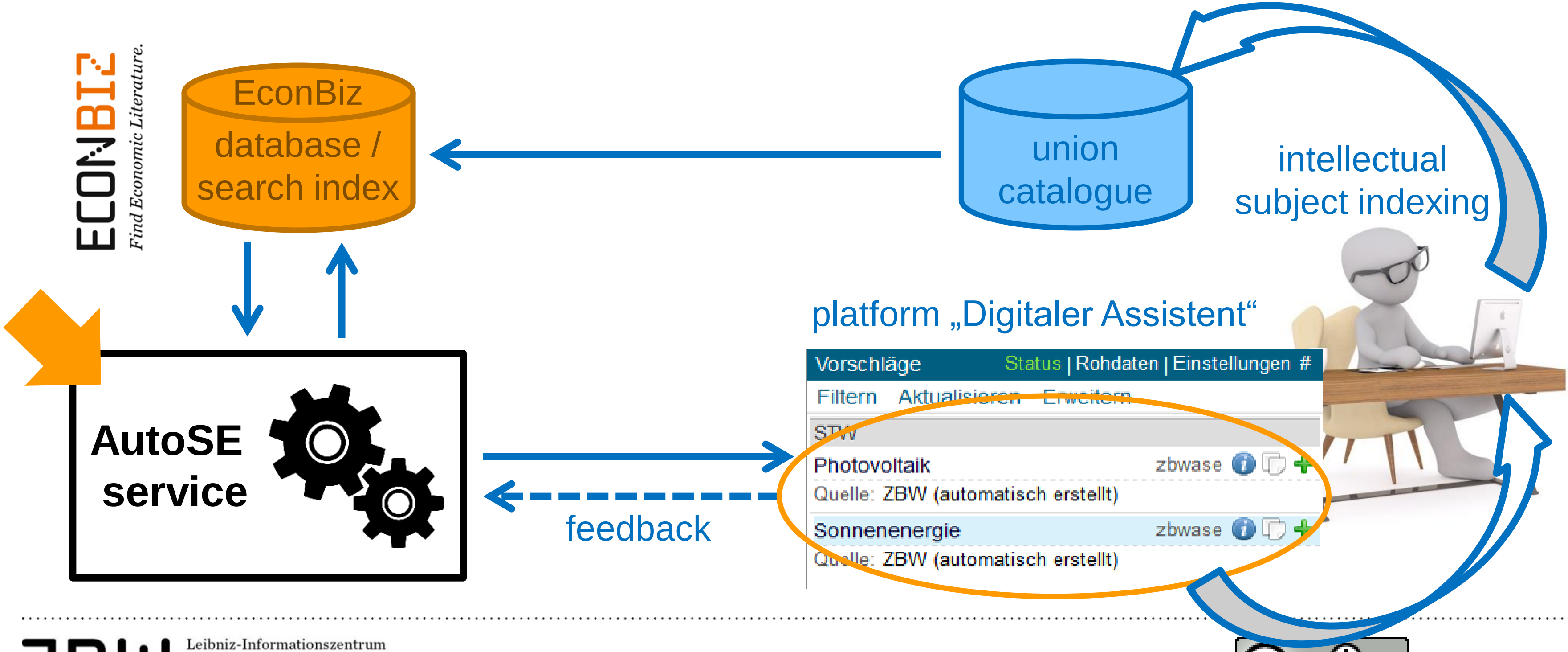
2014–2018 in-house applied research

from 2019 on: setting up a productive service



📌 Milestone **„change status from project to permanent task“**: ✓

Data flows: interaction between productive systems



ECONBIZ
Find Economic Literature.
EconBiz database / search index
union catalogue
intellectual subject indexing
AutoSE service
feedback

platform „Digitaler Assistent“

Vorschläge Status | Rohdaten | Einstellungen #

Filtern Aktualisieren Erweitern

STW

Photovoltaik zbwase

Quelle: ZBW (automatisch erstellt)

Sonnenenergie zbwase

Quelle: ZBW (automatisch erstellt)

Machine learning methods & framework

- from 2016 – applied research at ZBW resulting in a prototype
  - *meanwhile in Helsinki* … National Library of Finland (NLF) develops Annif * – an open source toolkit with the ambition to be easy to use
- from 2019:
  - ZBW uses Annif as a framework, accompanied by components of our own
  - ZBW is involved into the continued development of Annif, assists NLF in giving tutorials and provides other institutions with advice on how to deploy it in practice

* https://github.com/NatLibFi/Annif

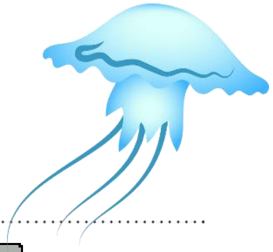
Milestone „improved methods“ (from 2019): ✓

- we combine state-of-the-art algorithms incl. a custom model developed at ZBW (stwfsa *) in a so-called *ensemble*
- complemented by a subsequent application of filters and rules
- additional experiments with transformer models (Deep Learning)
- separate search for optimal parameters (currently not provided by Annif)
- inhouse development of an automated quality control („*qualle*“)
- integration into metadata workflows at ZBW

omikuji

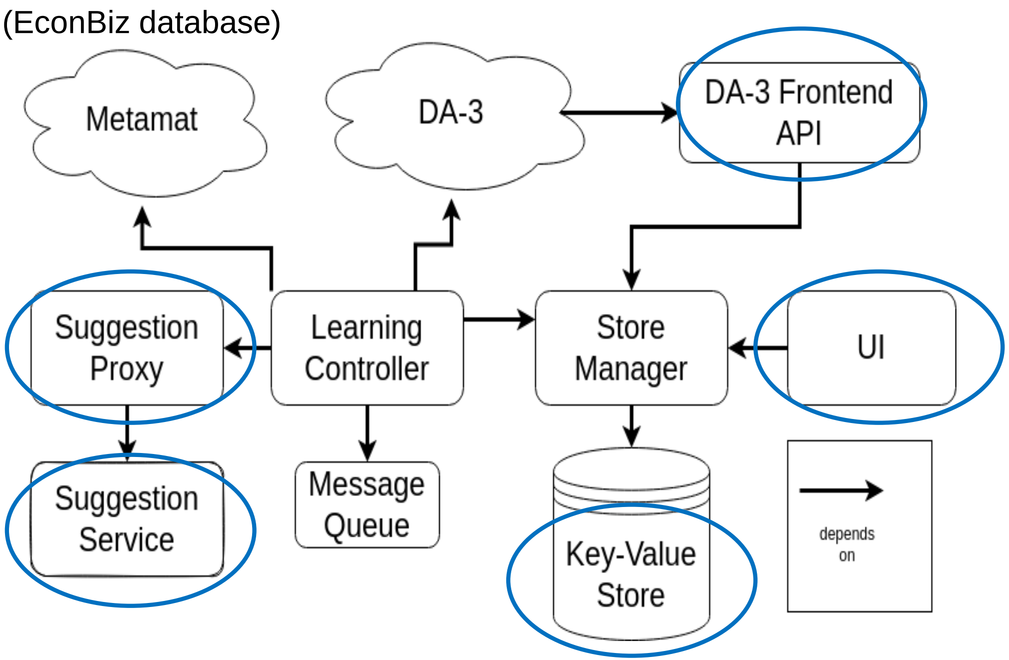
parabel *bonsai*

fastText



* https://github.com/zbw/stwfsapy

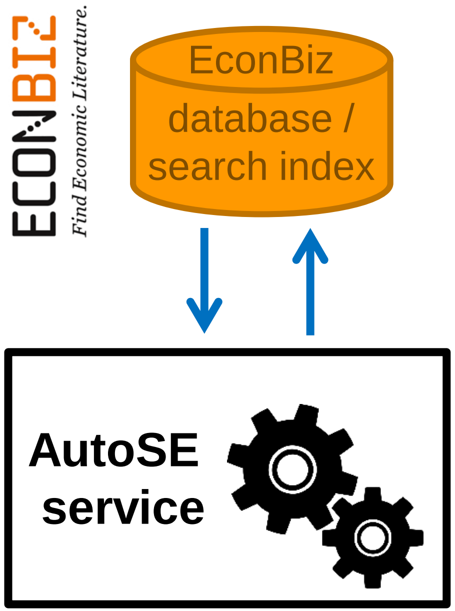
Milestone „implementing the AutoSE architecture“: ✓



- Suggestion Service: generates subjects (Annif)
- Suggestion Proxy: applies quality filters (among other things)
- Key-Value Store: stores subjects
- DA-3 API: fetches subjects from Store on request from DA-3
- UI: displays statistics

Milestone „communicating with the EconBiz database“: ✓

- we check the EconBiz database for new publications hourly and apply our subject indexing directly
- currently we filter for language „english“
- currently we only use titles and author keywords, if available (the use of abstracts is planned for 2022)



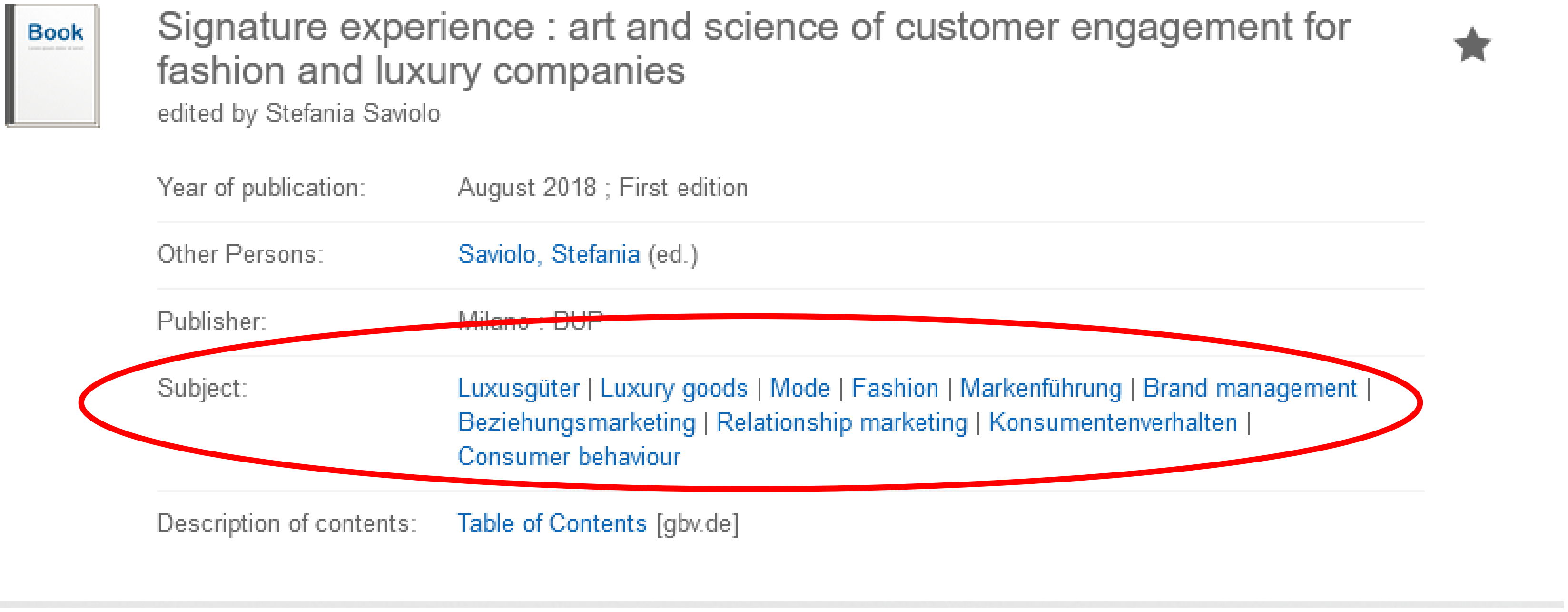
ECONBIZ

Find Economic Literature.

EconBiz database / search index

AutoSE service

Display of subjects in EconBiz



Signature experience : art and science of customer engagement for fashion and luxury companies

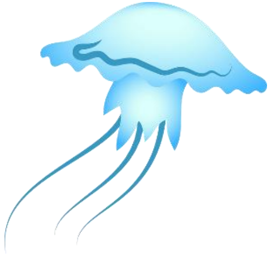
edited by Stefania Saviolo

Year of publication:	August 2018 ; First edition
Other Persons:	Saviolo, Stefania (ed.)
Publisher:	Milano : BUP
Subject:	Luxusgüter | Luxury goods | Mode | Fashion | Markenführung | Brand management | Beziehungsmarketing | Relationship marketing | Konsumentenverhalten | Consumer behaviour
Description of contents:	Table of Contents [gbv.de]

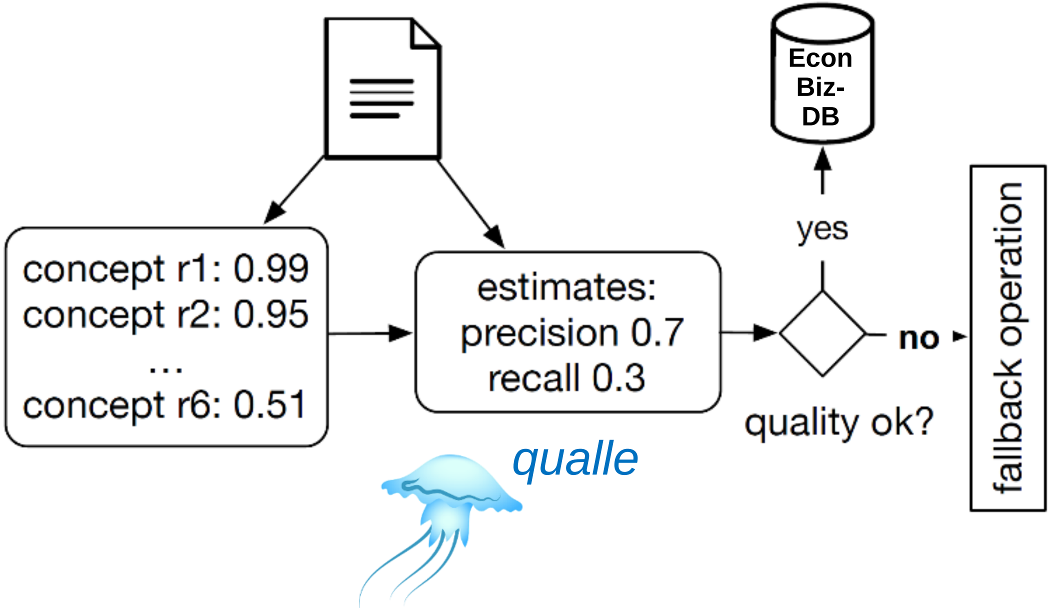
Quality assurance

- Task: make sure that our output meets a certain standard

- we are working on a comprehensive quality assurance concept
  - thresholds based on metrics such as F1 score
  - machine-learning-based quality control: *qualle*



Milestone „transfer *qualle* into productive operations“: ✓



- *qualle*:
  machine-learning-based quality estimation on the document level

- *qualle* is used in productive operations since spring of 2022

- perspectively: if *qualle* score is too low, forward to a human

https://github.com/zbw/qualle

Toepfer, M. & Seifert, C. „Content-Based Quality Estimation for Automatic Subject Indexing of Short Texts under Precision and Recall Constraints“ Proc. of TPDL (2018)

Quality assurance – *human in the loop*

- Task: make sure that our output meets a certain standard

- we are working on a comprehensive quality assurance concept
  - thresholds based on metrics such as F1 score
  - machine-learning-based quality control

- essential building block:
  human in the loop *– ways for humans and machine learning algorithms to interact to solve problems*

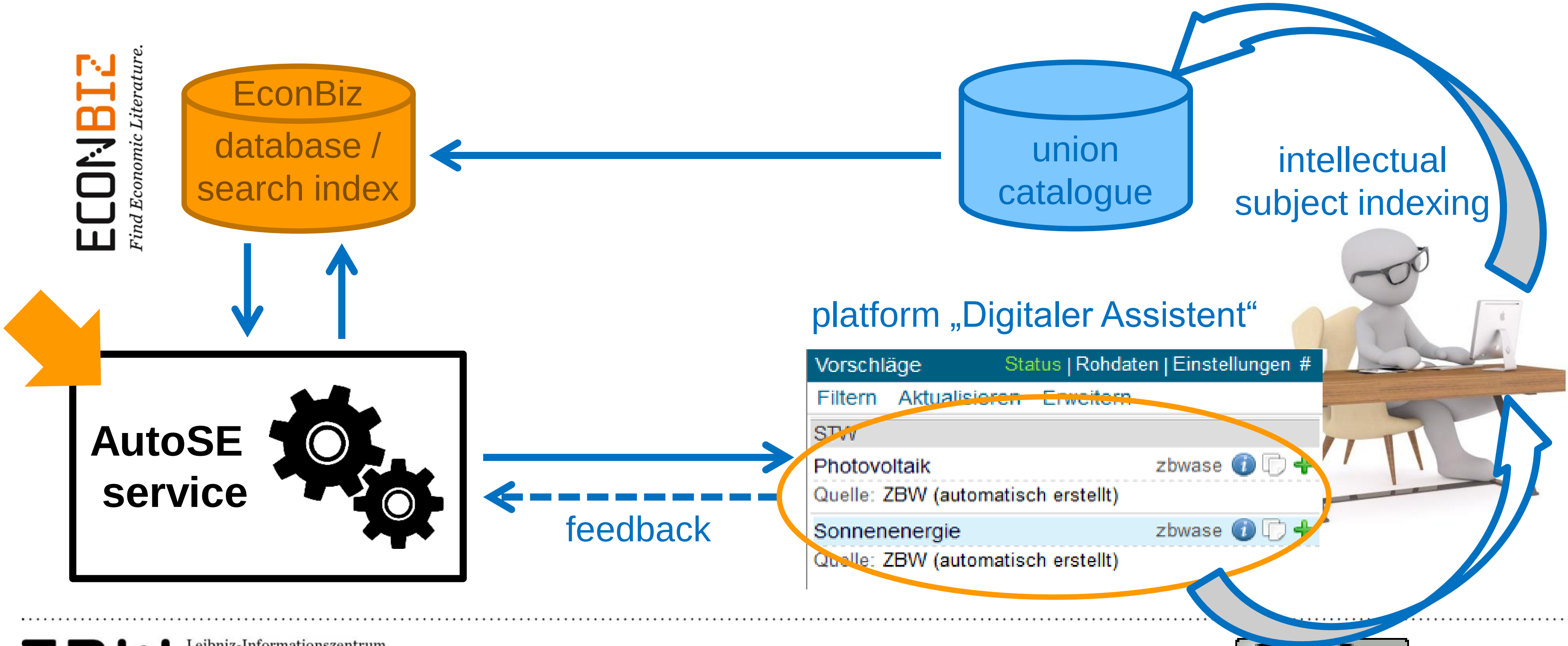
Quality assurance – *human in the loop*

broad spectrum of interpretations:

- intellectually annotated training data
- intellectually curated knowledge organization systems and mappings
- machine-assisted subject indexing
- intellectual assessment of the output,
  identifying systematic deviations
  from desired output
- Online Learning, Active Learning

https://livebook.manning.com/book/human-in-the-loop-machine-learning/chapter-1

Data flows: interaction between productive systems


ECONBIZ
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Vorschläge Status | Rohdaten | Einstellungen #

Filtern Aktualisieren Erweitern

STW

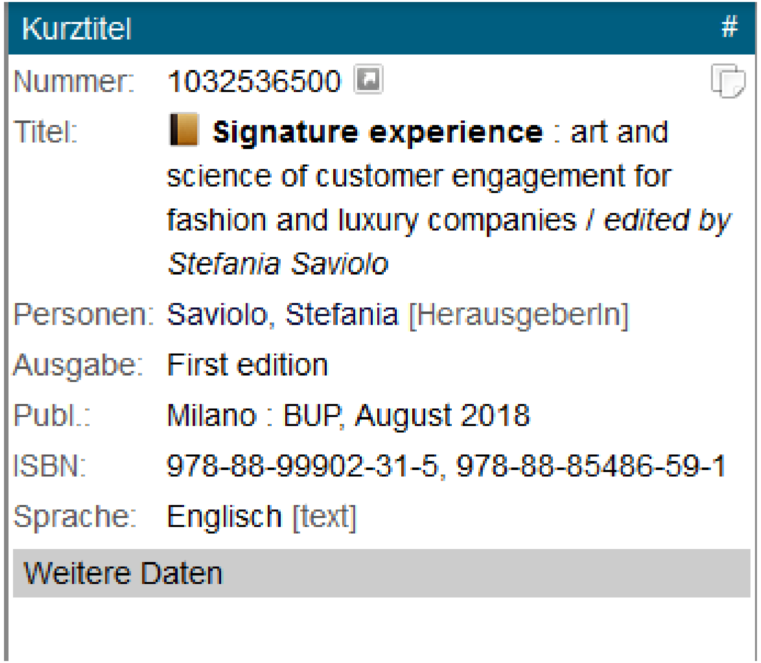
Photovoltaik zbwase

Quelle: ZBW (automatisch erstellt)

Sonnenenergie zbwase

Quelle: ZBW (automatisch erstellt)

Milestone „displaying suggestions for intellectual subject indexing“:



Kurztitel #

Nummer: 1032536500

Titel: **Signature experience** : art and science of customer engagement for fashion and luxury companies / *edited by Stefania Saviolo*

Personen: Saviolo, Stefania [HerausgeberIn]

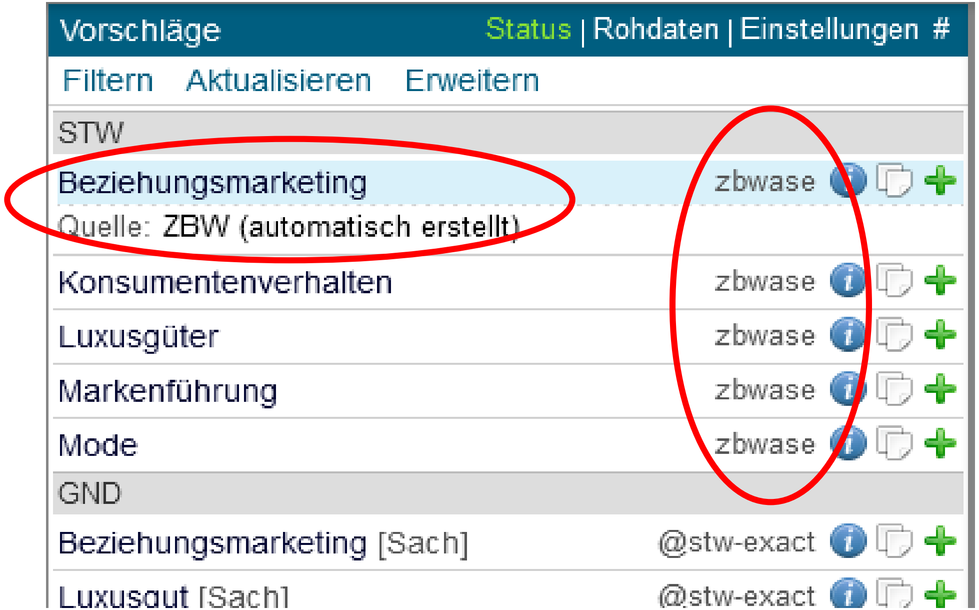
Ausgabe: First edition

Publ.: Milano : BUP, August 2018

ISBN: 978-88-99902-31-5, 978-88-85486-59-1

Sprache: Englisch [text]

Weitere Daten



Vorschläge Status | Rohdaten | Einstellungen #

Filtern Aktualisieren Erweitern

STW

Beziehungsmarketing zbwase

Quelle: ZBW (automatisch erstellt)

Konsumentenverhalten zbwase

Luxusgüter zbwase

Markenführung zbwase

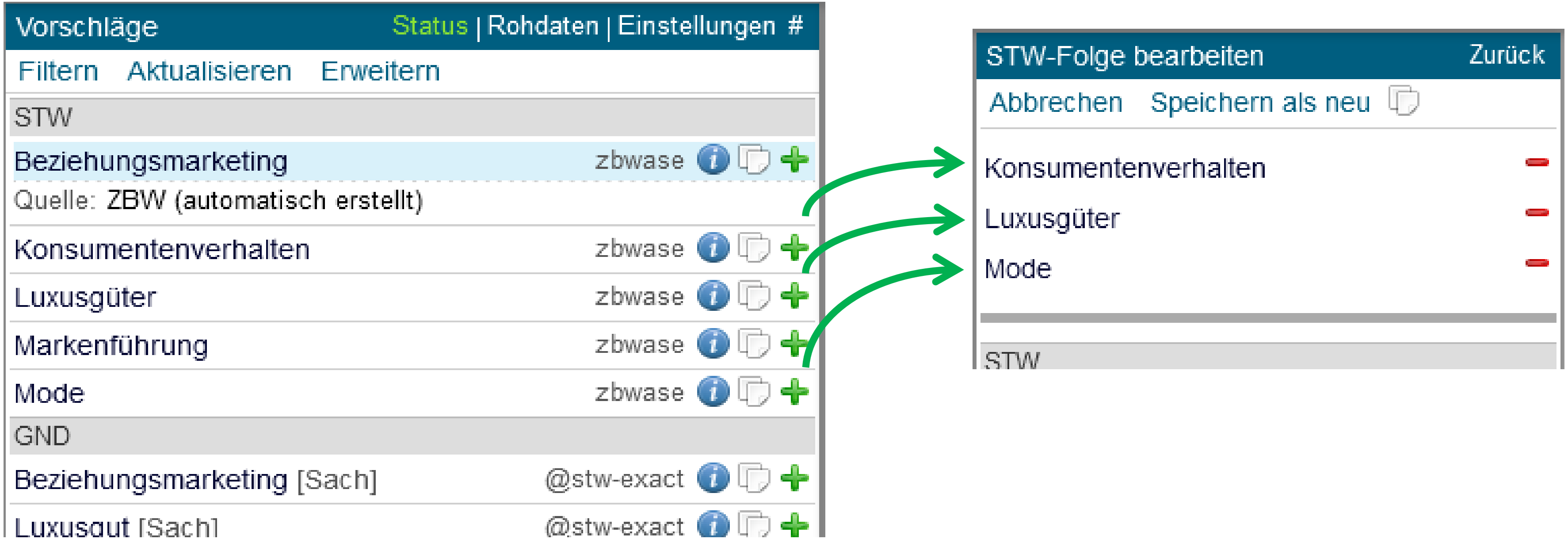
Mode zbwase

GND

Beziehungsmarketing [Sach] @stw-exact

Luxusgut [Sach] @stw-exact

Machine-assisted intellectual subject indexing



Vorschläge
Status | Rohdaten | Einstellungen #
Filtern Aktualisieren Erweitern

STW

Beziehungsmarketing zbwase

Quelle: ZBW (automatisch erstellt)

Konsumentenverhalten zbwase

Luxusgüter zbwase

Markenführung zbwase

Mode zbwase

GND

Beziehungsmarketing [Sach] @stw-exact

Luxusgut [Sach] @stw-exact

STW-Folge bearbeiten
Zurück
Abbrechen Speichern als neu

Konsumentenverhalten

Luxusgüter

Mode

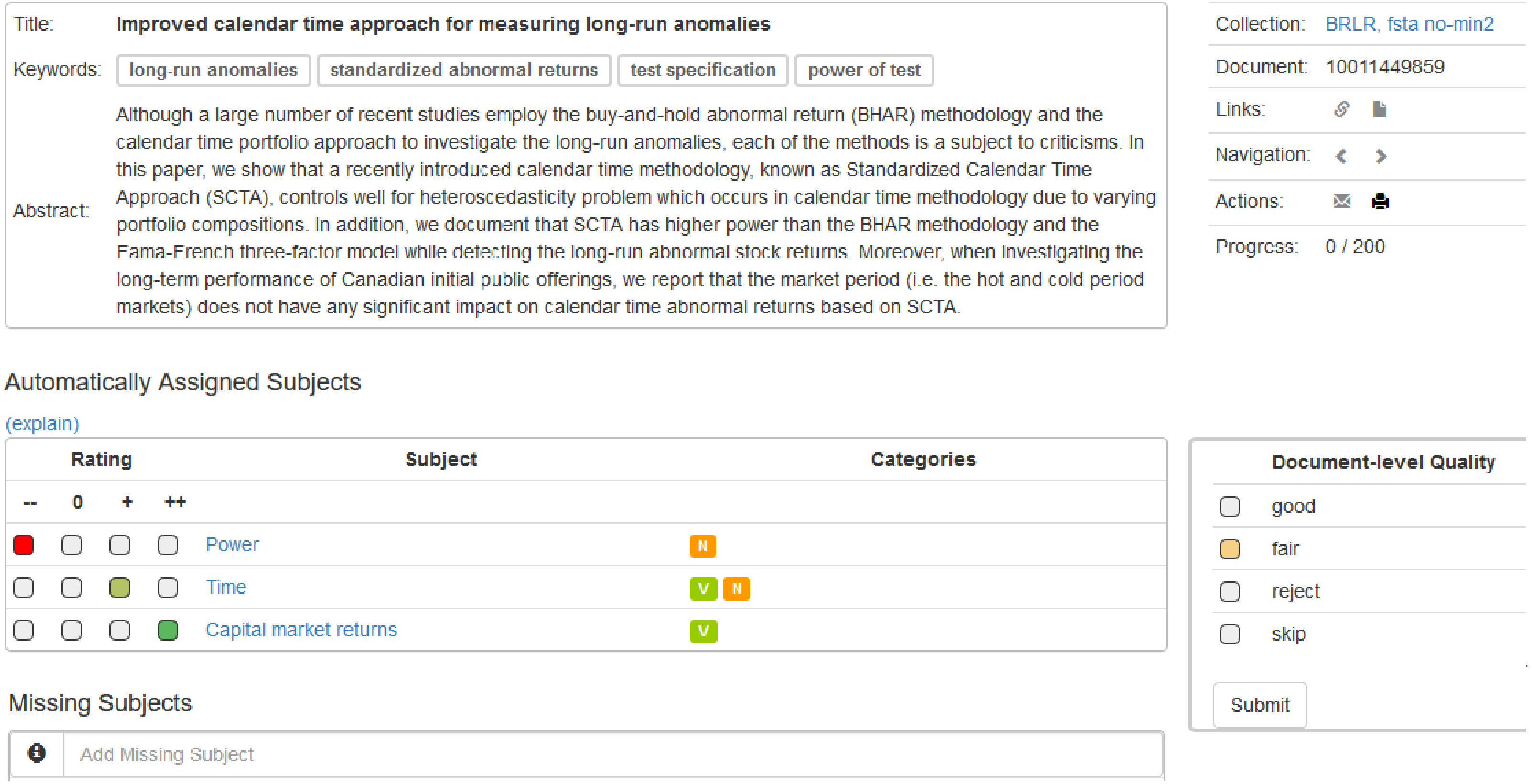
STW

Quality assessment via intellectual reviews

Procedure:

- apply method under review to newest datadump of EconBiz database (several million data records)
- random sample of ~1000 documents per review
- 7 oder 8 reviewers
- over a period of ~4 weeks

Reviews – Milestone „getting quality improvement confirmed“: ✓



Title:	**Improved calendar time approach for measuring long-run anomalies**
Keywords:	long-run anomalies · standardized abnormal returns · test specification · power of test
Abstract:	Although a large number of recent studies employ the buy-and-hold abnormal return (BHAR) methodology and the calendar time portfolio approach to investigate the long-run anomalies, each of the methods is a subject to criticisms. In this paper, we show that a recently introduced calendar time methodology, known as Standardized Calendar Time Approach (SCTA), controls well for heteroscedasticity problem which occurs in calendar time methodology due to varying portfolio compositions. In addition, we document that SCTA has higher power than the BHAR methodology and the Fama-French three-factor model while detecting the long-run abnormal stock returns. Moreover, when investigating the long-term performance of Canadian initial public offerings, we report that the market period (i.e. the hot and cold period markets) does not have any significant impact on calendar time abnormal returns based on SCTA.

Collection:	BRLR, fsta no-min2
Document:	10011449859
Links:	
Navigation:	‹ ›
Actions:	✉
Progress:	0 / 200

Automatically Assigned Subjects

(explain)

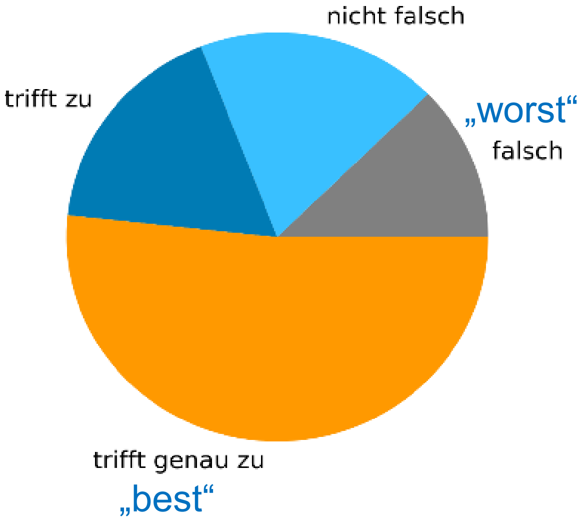
Rating				**Subject**	**Categories**
--	**0**	**+**	**++**		
🟥	□	□	□	Power	N
□	□	🟩	□	Time	V N
□	□	□	🟩	Capital market returns	V

Document-level Quality	
□	good
🟧	fair
□	reject
□	skip

Missing Subjects

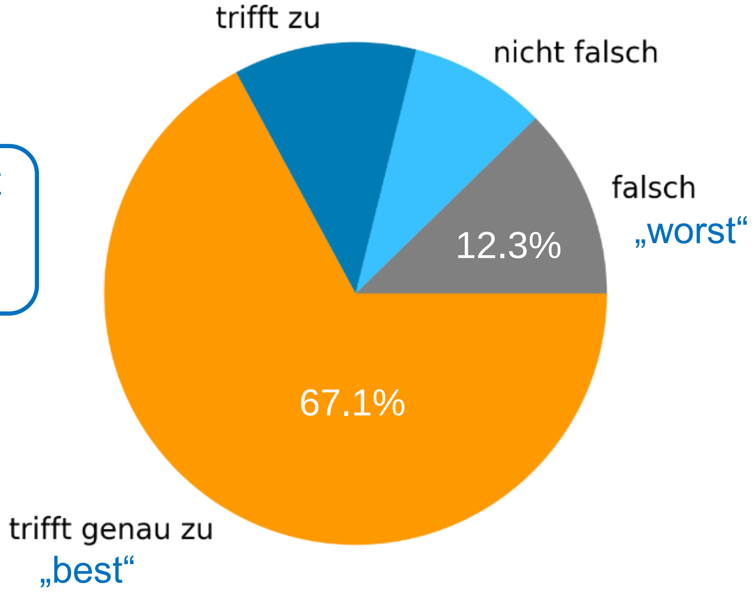
Intellectual reviews show improvement in quality

2019



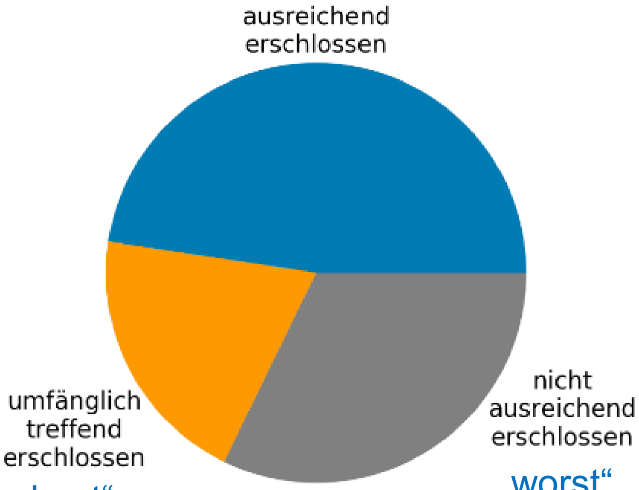
assessment of individual subjects

2020



Intellectual reviews show improvement in quality

2019

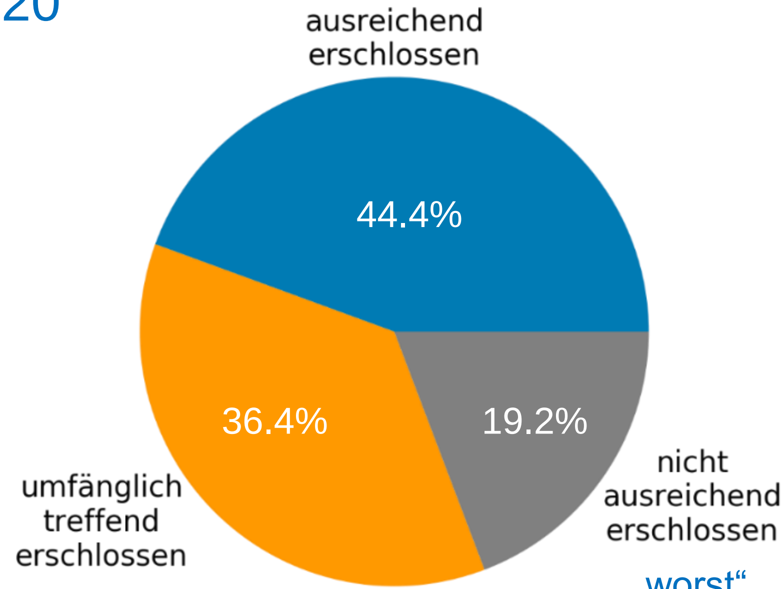


„best“

„worst“

assessment on document level

2020



„best“

„worst“

Leibniz-Informationszentrum
Wirtschaft
Leibniz Information Centre
for Economics

Example for concrete lessons learned from reviews

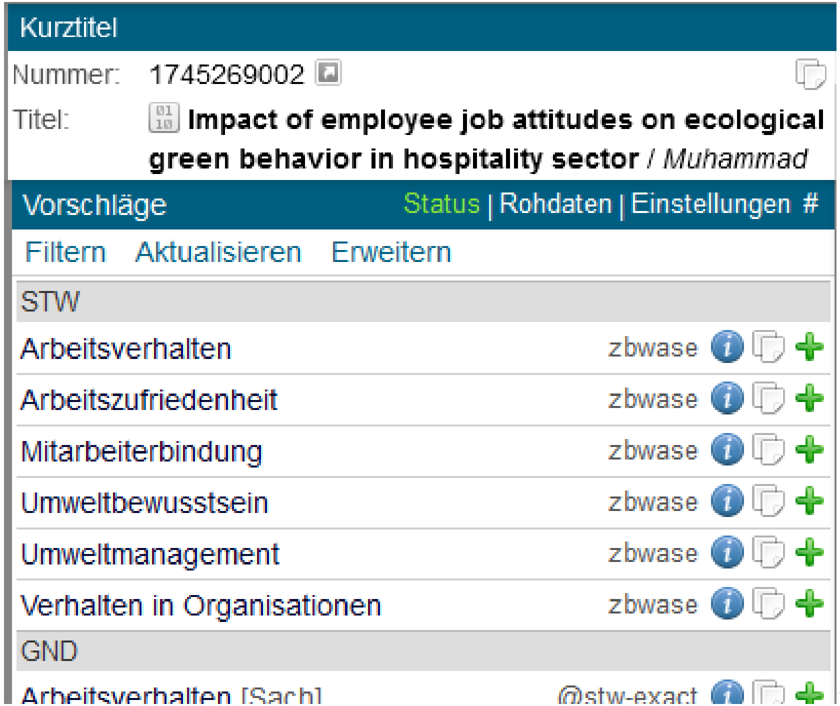
Review 2020:

- experts noticed that AutoSE falsely suggests „theory“ and „USA“ far too often
- explanation: „theory“ (27%) and „USA“ (16%) are also the most frequent subjects in intellectually annotated training data!

how do we fix this? two new filters:

- block „USA“ except when „USA“ („US“, „United States“) appears explicitly
- experts provided us with a list of subjects describing specific theories that should block „theory“

Milestone „enabling intellectual assessments within DA-3“: ✓



Kurztitel

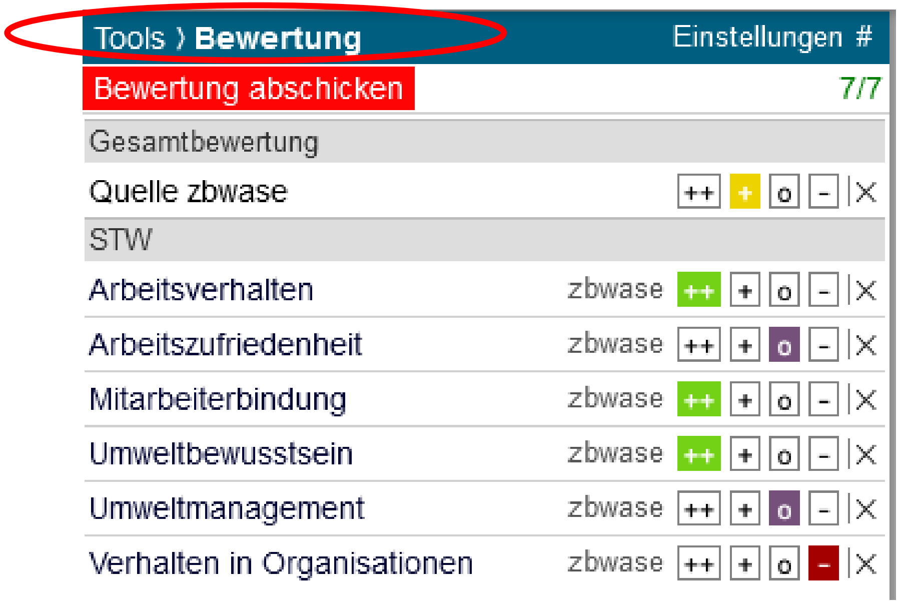
Nummer: 1745269002

Titel: Impact of employee job attitudes on ecological green behavior in hospitality sector / *Muhammad*

Vorschläge — Status | Rohdaten | Einstellungen #

Filtern Aktualisieren Erweitern

STW		
Arbeitsverhalten	zbwase	+
Arbeitszufriedenheit	zbwase	+
Mitarbeiterbindung	zbwase	+
Umweltbewusstsein	zbwase	+
Umweltmanagement	zbwase	+
Verhalten in Organisationen	zbwase	+
GND		
Arbeitsverhalten [Sach]	@stw-exact	+



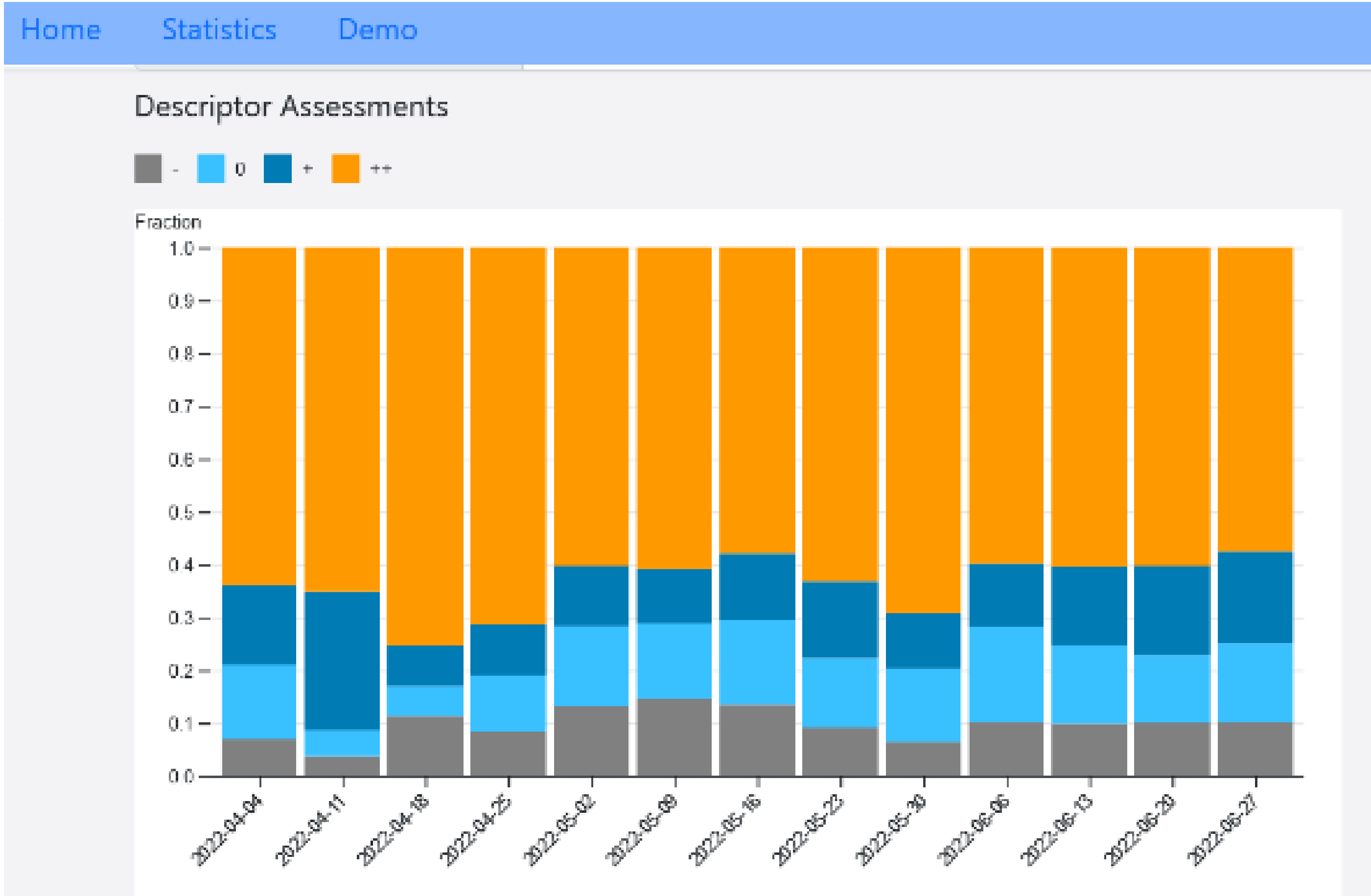
Tools 〉 **Bewertung** — Einstellungen #

Bewertung abschicken — 7/7

Gesamtbewertung		
Quelle zbwase		++ [✓ +] o - X
STW		
Arbeitsverhalten	zbwase	[✓ ++] + o - X
Arbeitszufriedenheit	zbwase	++ + [✓ o] - X
Mitarbeiterbindung	zbwase	[✓ ++] + o - X
Umweltbewusstsein	zbwase	[✓ ++] + o - X
Umweltmanagement	zbwase	++ + [✓ o] - X
Verhalten in Organisationen	zbwase	++ + o [✓ -] X

coming soon:

AutoSE web UI with a demo, statistics on performance, background information, etc.



Future plans – (some) next steps in pilot phase

- Web-UI with a demo, information and statistics concerning AutoSE to increase transparency
- abstracts and tables of content
- multi-lingual subject indexing (transformer models)
- automation of machine learning procedures (parameters, training, …)
- finalize documentation of requirements of productive operations (!)

Lessons 1

- declaring the automation of subject indexing a permanent task was essential
- productive operations need reliable permanent resources
- there is no shelf-ready open source subject indexing solution (yet) – for the implementation of a suitable architecture, various in-house expertise is needed
  - roles: coordination, applied research, software architecture development and administration

Adjusting expectations and goals

- NB: interindexer consistency is about 30 to 40%
- this fuzziness is ingrained in the training data
    - maybe there is no absolute truth concerning „aboutness“?
    - maybe „aboutness“ depends on the (search) context?
    - do our subject indexing rules and practices reflect that?
- automating legacy subject indexing practices is only the first step
- gradual transformation of subject indexing via new technologies – semantic technologies, „human in the loop“ (Online Learning, Active Learning, …)

Lessons 2 – „get everybody on board before you get going“

- working together with subject librarians is essential
- in order to effect long-term changes
  you need to ensure acceptance
- in order to overcome reservations
  and to ensure acceptance
  you need to create transparency

Thank you!

Open Source Software used:

- Annif: https://github.com/NatLibFi/Annif
- published by ZBW: https://github.com/zbw (/stwfsapy; /qualle; /releasetool)
- technologies: Kubernetes, Elasticsearch, Kibana, Python, REST, Helm, GitLab, Ceph, Rook, Prometheus, Grafana, CouchDB, RabbitMQ, Svelte, …

Slides and publications about AutoSE see link at the bottom of this page: https://www.zbw.eu/en/about-us/key-activities/automated-subject-indexing/

Contact: {a.kasprzik,autose}@zbw.eu