

Large Language Models are Pattern Matchers

Editing Semi-Structured and Structured Documents with ChatGPT

Irene Weber

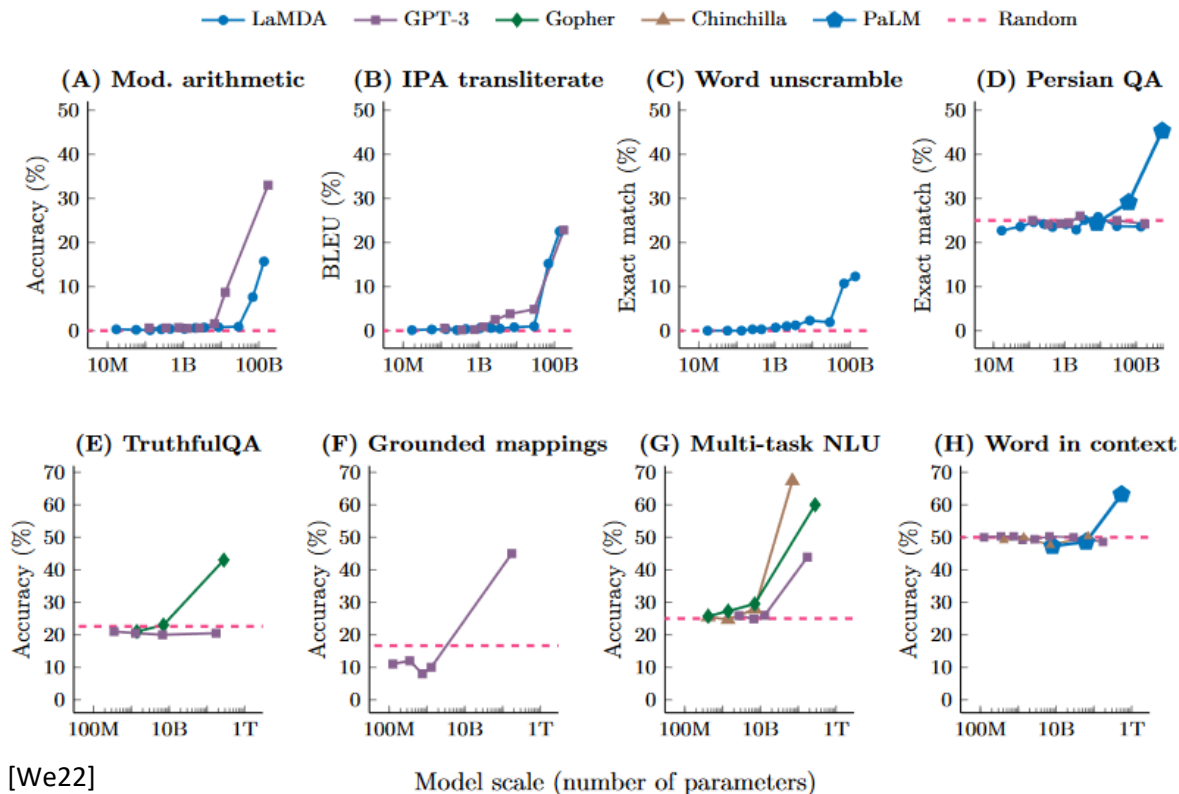
AKWI '24

37. Annual Conference of Arbeitskreis Wirtschaftsinformatik
10. September 2024 @HAW Landshut

The telescope was an **invention**. But looking through it at Jupiter, knowing it had moons, was a discovery.

Large language models are much more like **discoveries**. We're constantly getting surprised by their capabilities.

Jeff Bezos [Fr23]



[We22]

LLMs are Universal Tools

Application:

Reorganizing Structured and Semi-Structured Texts

LLM as a Writing Assistant –
not for creativity,
but as a Super-Formatter



Structure tags describe
the meaning of text
parts

RQ

Quickly Restructure and Transform Text with Simple Prompts
Directly in the Chat Interface —How Effective Is It?

```

\begin{tabular}{llll}
Index & Topic & Course & Literature \\
\hline
0 & Python 101 & Introductory Course & \cite{smithPython101Introduction2023a, smithPython101Advanced2023} \\
1 & Java Fundamentals & Object-oriented Programming & \cite{jonesJavaFundamentalsBeginners2023}, \\
\href{https://github.com/example/JavaFundamentals}{Code} \\
2 & Java Fundamentals & GUI Development & \cite{jonesJavaFundamentalsGUI2023}, \\
\href{https://github.com/example/JavaFundamentals}{Code} \\
3 & DataScienceBasics & Data Analysis & \cite{brownDataScienceBasics2023}, \\
4 & Data Science Basics & Machine Learning Models & \cite{brownDataScienceBasics2023}, \\
5 & Data Science Basics & Data Visualization & \cite{brownDataScienceBasics2023}, \\
6 & Cyber Security Fundamentals & Network Security Fundamentals & \cite{thompsonCyberSecurityPro2024, williamsCyberSecurityPro2023} \\
7 & Cyber Security Fundamentals & Ethical Hacking & \cite{thompsonCyberSecurityPro2024, williamsCyberSecurityPro2023} \\
8 & Web Development 101 & Frontend Development & \cite{williamsWebDevelopment1012023}, \\
9 & Mobile App Development & App Development Basics & \cite{williamsMobileAppDevelopment2023}, \\
a,b & Mobile App Development & Backend Integration & \cite{williamsMobileAppDevelopment2023} \\
\hline
A & Machine Learning Mastery & Neural Networks & [13] \\
B & Machine Learning Mastery & Reinforcement Learning & [13] \\
C & Cloud Computing Essentials & Cloud Infrastructure & [5] \\
D & Database Management Systems & Database Design & [1] \\
E & Database Management Systems & Query Optimization & [1] \\
F & Game Development Basics & Graphics Programming & [6] \\
G & Cyber Security Professional & Incident Response & [10, 11] \\
H & Cyber Security Professional & Penetration Testing & [10, 11] \\
I & Cyber Security Professional & Threat Intelligence & [10, 11] \\
J & Cyber Security Professional & Cryptography & [10, 11] \\
\hline
\end{tabular}

```

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J	Cyber Security Professional	Cryptography	[10, 11]

Method

Experiment 1: LaTeX

Reorganize a LaTeX table

LaTeX → LaTeX

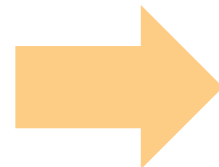
Experiment 2: Biblio

Transform Bibliographic Data

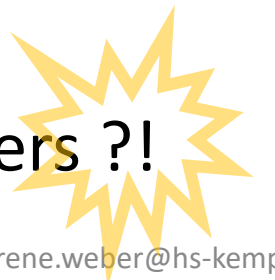
RIS → Opus XML

LLM: ChatGPT on April 29, to May 1, 2024 (gpt-3.5)


Qualitative Research design
Few cases & detailed analyses




LLMs are Pattern Matchers ?!



No	Prompt	Result
1	I will give you a LaTeX table. Please delete the first column. '''	Fig. 2
2a	I will give you a LaTeX table. Please swap the two last columns. '''	
2b	I will give you a LaTeX table. Please swap the "Course" and "Literature" columns'''	Fig. 3
3a	I will give you a LaTeX table. I want you to reduce the number of lines as follows. Some lines only differ in the last column. Please collapse these lines in one line. Collect their last column data.	Fig. 4
3b	identical to 3a	



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Mobile App Development	[9]	Backend Integration
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Machine Learning Mastery	[13]	Reinforcement Learning
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Database Management Systems	[1]	Query Optimization
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Cyber Security Professional	[10, 11]	Penetration Testing
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Cyber Security Professional	[10, 11]	Cryptography

the entries in the "Course" containing commas as it is. '''

the entries in the "Courses" in one cell, separated by as it is. '''

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- 4a I will give you a LaTeX table. Please format the entries in the "Course" column in *Italics*. Keep the formatting of separating commas as it is. '''
- 4b I will give you a LaTeX table. Please format the entries in the "Courses" column in *Italics*. There may be multiple entries in one cell, separated by commas. Keep the formatting of separating commas as it is. '''
- 4c I will give you a LaTeX table. Please format the entries in the "Courses" column in *Italics*. There may be multiple entries in one cell, separated by commas. Spare the commas out. '''
- 4d I will give you a LaTeX table. Please format the entries in the "Courses" column in *Italics* excluding the commas. '''

Result

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Topic	Literature	Courses
Python 101	[8, 7]	<i>Introductory Course</i>
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Experiment 1 LaTeX – Result

Always Produces Correct LaTeX

Understands LaTeX Structure Very Well

? Column Titles Are Better Than Column Numbers

? Commas as Structure Indicators Are Problematic

Experiment 2 Biblio

Convert between two formats

Real-world data


Less well-known formats (than LaTeX)

RIS → OPUS XML

[Zurück zur Trefferliste](#)

Treffer 1 von 1


EtherCAT Gateway für eine Arduino basierte LuftqualitätsMessung zur Visualisierung an eine Beckhoff SPS

 Stefan Seehuber, Peter Crämer, Stefan Kipfelsberger, Martin Versen

Abstract

DE Die Luftqualität in Innenräumen ist besonders ausschlaggebend für die Konzentrations- und Leistungsfähigkeit [1] – und in Zeiten von Corona auch für den Infektionsschutz. Die Qualität der Luft kann u.a. aus dem CO₂-Gehalt, der Temperatur, der Luftfeuchte und verschiedenen Feinstaubwerten abgeleitet werden [2]. Die Entwicklung eines Messsystems zur automatischen Messung der Luftqualität und der Übertragung der Messdaten an eine Software-SPS wird auf Basis einer Bachelor-Arbeit [3] vorgestellt. Dies beinhaltet die Softwareentwicklung in diversen Systemkomponenten und die Inbetriebnahme eines funktionsfähigen Prototyps.

Volltext Dateien herunterladen

 [3ESI2022_Tagungsband_Seehuber.pdf](#) (1170KB)



Metadaten exportieren

[BibTeX](#)[RIS](#)[XML](#)

Data

TY - CONF
A1 - Seehuber, Stefan
A1 - Crämer, Peter
A1 - Kipfelsberger, Stefan
A1 - Versen, Martin
A2 - Artem, Ivanov
A2 - Marc, Bicker
A2 - Peter, Patzelt

T1 - EtherCAT Gateway für eine Arduino basierte LuftqualitätsMessung zur Visualisierung an Beckhoff SPS

T2 - Tagungsband 3. Symposium Elektronik und Systemintegration ESI

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Y1 - 2022

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SN - 978-3-9818439-6-5

SP - 98

EP - 106

ER -

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    <author>Peter Crämer</author>
    <author>Stefan Kipfelsberger</author>
    <author>Martin Versen</author>
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9/2024, Irene Weber, irene.weber@hs-kempten.de

TY - CONF
 A1 - Seehuber, Stefan
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<collection role="collections" number="">Tagungsband 3. Symposium E
  
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[SH24]	SELIGER	THR	CIPS 2024		18	36

I will input a ris-document. Please convert it to Opus-XML. First, you will be provided with an example input and output.

Here is the example input: '''**%%1**'''

Here is the example output: '''**%%2**'''

Here is the ris-document you must convert:'''**%%3**'''

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N2 - Die Luftqualität in Innenräumen ist besonders ausschlaggebend für die Konzentrations- und Leistungsfähigkeit [1] – und in Zeiten von Corona auch für den Infektionsschutz. Die Qualität der Luft kann u.a. aus dem CO2-Gehalt, der Temperatur, der Luftfeuchte und verschiedenen Feinstaubwerten abgeleitet werden [2]. Die Entwicklung eines Messsystems zur automatischen Messung der Luftqualität und der Übertragung der Messdaten an eine Software-SPS wird auf Basis einer Bachelor-Arbeit [3] vorgestellt. Dies beinhaltet die Softwareentwicklung in diversen Systemkomponenten und die Inbetriebnahme eines funktionsfähigen Prototyps.
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A1 - Frauenschläger, Tobias
A1 - Mottok, Jürgen
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A2 - Marc, Bicker
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N2 - The Transport Layer Security (TLS) protocol is used to cryptographically secure network connections. To ensure authenticity, TLS uses certificates that are exchanged at the beginning of each new connection. Due to expiration or early revocation of certificates, the deployment of new certificates to devices in the field is necessary. In addition, a device must identify revoked certificates during connection establishment to abort the connection. This paper presents the implementation of these two functionalities within a Security Gateway for the power grid. The nature of embedded systems with their limited resources and requirements regarding dependability impact the device-specific implementation. With these features existing Public-Key Infrastructure System.
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Here is the example output: ''' %%2 '''

Here is the ris-document you must convert: ''' %%3 '''

Seehuber – one-shot example

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A1 - Krämer, Peter
A1 - Kipfelsberger, Stefan
A1 - Versen, Martin
A2 - Artem, Ivanov
A2 - Marc, Bicker
A2 - Peter, Patzelt
T1 - EtherCAT Gateway für e
Beckhoff SPS
T2 - Tagungsband 3. Symposi
N2 - Die Luftqualität in In
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Seliger – a task

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a declined magnetic field shielding
KW - EMI
KW - Shielding tape
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KW - adhesive conductive EMI shield
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Seehuber – one-shot example

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T2	Tagungsband 3. Symposium Elektronik und Systemintegration ESI
UR	https://opus4.kobv.de/opus4-haw-landshut/frontdoor/index/index/docId/366
f	https://opus4.kobv.de/opus4-haw-landshut/files/366/3ESI2022_Tagungsband_Seehuber.pdf

RIS →

XML →

Values from MUENCH.RIS and generated by ChatGPT

Y1	2022
A1	Münch, Andreas
A1	Frauenschläger, Tobias
A1	Mottok, Jürgen
T2	Tagungsband 3. Symposium Elektronik und Systemintegration ESI
UR	https://opus4.kobv.de/opus4-haw-landshut/frontdoor/index/index/docId/365
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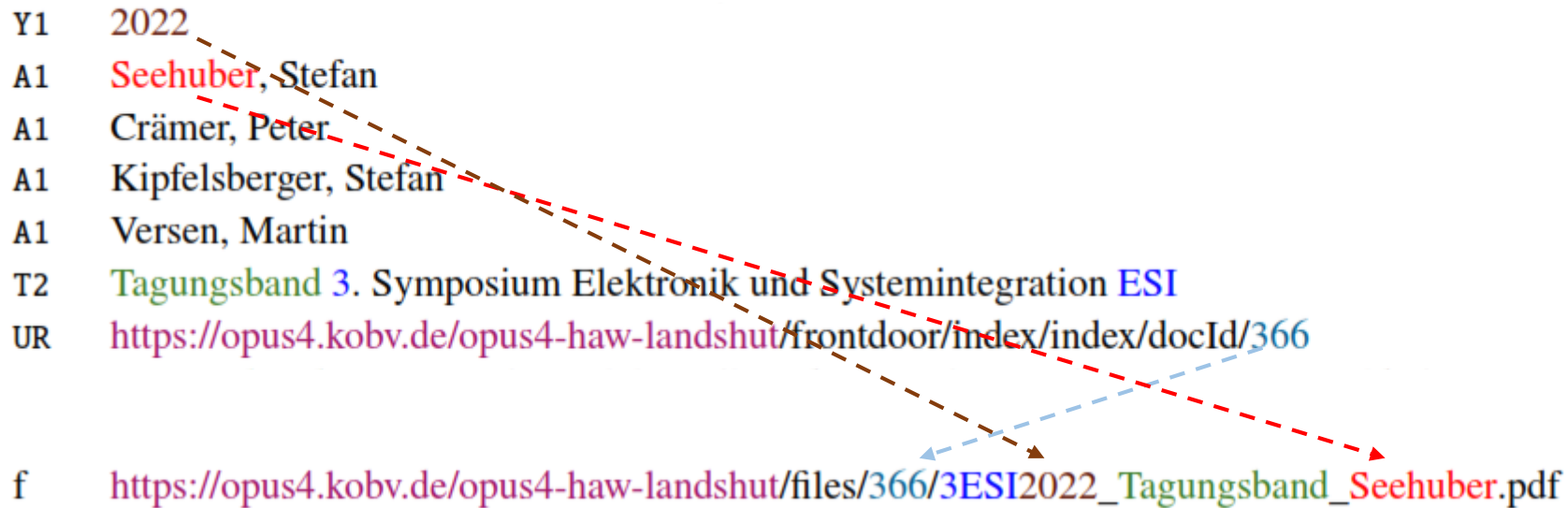
RIS →

→ XML

Values from SEEHUBER.RIS and SEEHUBER.XML

Y1 2022
A1 Seehuber, Stefan
A1 Crämer, Peter
A1 Kipfelsberger, Stefan
A1 Versen, Martin
T2 Tagungsband 3. Symposium Elektronik und Systemintegration ESI
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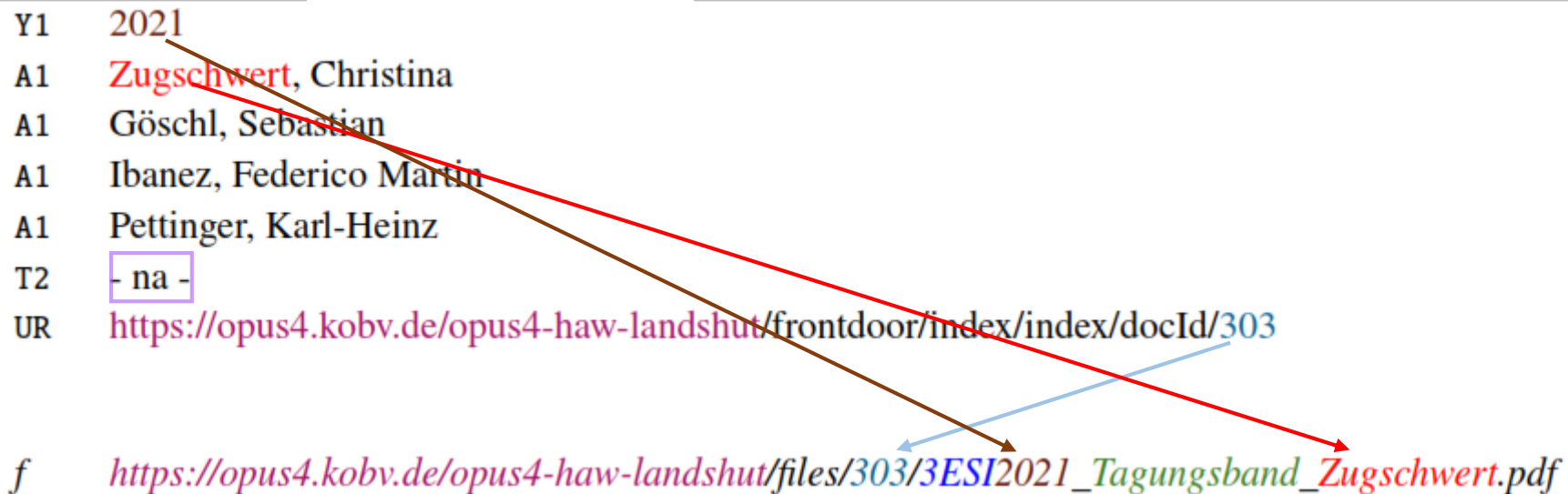
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Values from ZUGSCHWERT.RIS and generated by ChatGPT

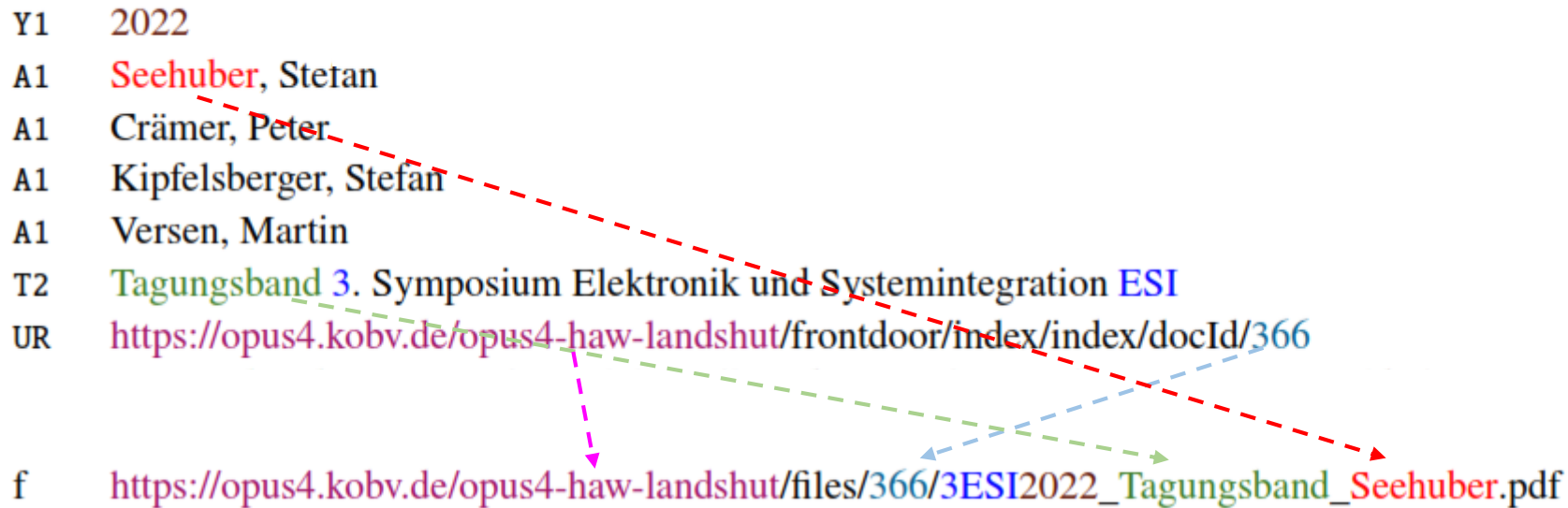
Y1 2021
A1 Zugschwert, Christina
A1 Göschl, Sebastian
A1 Ibanez, Federico Martin
A1 Pettinger, Karl-Heinz
T2 - na -
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f https://opus4.kobv.de/opus4-haw-landshut/files/303/3ESI2021_Tagungsband_Zugschwert.pdf



Values from SEEHUBER.RIS and SEEHUBER.XML

Y1 2022
A1 **Seehuber**, Stefan
A1 Crämer, Peter
A1 Kipfelsberger, Stefan
A1 Versen, Martin
T2 **Tagungsband 3**. Symposium Elektronik und Systemintegration **ESI**
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f https://opus4.kobv.de/opus4-haw-landshut/files/366/3ESI2022_Tagungsband_Seehuber.pdf



Values from SELIGER.RIS and generated by ChatGPT

Y1 2024
A1 **Seliger**, Norbert
A1 Helmbrecht, Cordula
T2 **Proccedings CIPS** 2024 - 13th International Conference on Integrated Power Electronics Systems
UR <https://opus4.kobv.de/opus4-rosenheim/frontdoor/index/index/docId/2386>
f https://opus4.kobv.de/opus4-rosenheim/files/2386/CIPS2024_Proceedings_Seliger.pdf



Seehuber – one-shot example

```
TY - CONF
A1 - Seehuber, Stefan
A1 - Crämer, Peter
A1 - Kipfelsberger, Stefan
A1 - Versen, Martin
A2 - Artem, Ivanov
A2 - Marc, Bicker
A2 - Peter, Patzelt
T1 - EtherCAT Gateway für e
Beckhoff SPS
T2 - Tagungsband 3. Symposi
N2 - Die Luftqualität in In
Leistungsfähigkeit [1] - und
Luft kann u.a. aus dem CO2-G
abgeleitet werden [2]. Die E
und der Übertragung der Mess
vorgestellt. Dies beinhaltet
Inbetriebnahme eines funktio
Y1 - 2022
UR - https://opus4.kobv.de/
UR - https://nbn-resolving.
SN - 978-3-9818439-6-5
SP - 98
EP - 106
ER -

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Seliger – a task

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A1 - Helmbrecht, Cordu
T1 - A high-frequency
during High-Temperature
T2 - Proceedings CIPS
N2 - The variation of
temperature storage (HT
as signal return paths
deterioration are analy
contact impedance degra
Contact resistance and
a declined magnetic fie
KW - EMI
KW - Shielding tape
KW - High-Temperature
KW - adhesive conducti
Y1 - 2024
UR - https://opus4.kob
SN - 978-3-8007-6288-0
SN - 0341-3934
SP - 297
EP - 303
PB - VDE VERLAG GMBH
CY - Düsseldorf
ER -

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<author>Cordula Helmbrecht</author>
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Experiment 2 Biblio – Result

Correct Conversion from RIS to XML:

- Author Names
- Number of Authors

Correctly Utilized Trained Knowledge:

- Language

No Hallucinations, as is correct:

- Did Not Invent New XML Tags for Keywords

Constructed Values ➡ LLM ist is a „Pattern Matcher“

Contributions

- Explored a novel research question: transforming (semi-)structured texts
- Employed a qualitative research design which is rarely used in the field
- Demonstrated that this LLM handles structural information very well RQ
- Proposed a practically useful application area
- Provided a new perspective on “hallucinations”
- Identified approaches for further research
 - „Pattern Matching“: how do hallucinations occur?
 - prompt design: is explicit structure helpful? [Bu24]

Related Worts

Ref	Purpose	Input	Output
[Wu20]	Identify co-reference	NL	SEM (XML)
[Wu20]	Resolve co-reference	SEM (XML)	STRUC
[Ar23]	Extract data	SEM (HTML, TXT, XML)	STRUC (DB)
[PM24]	Extract data	NL (scientific articles)	STRUC (DB)
[Mi23]	NLP tasks	NL	Diverse (SEM, NL, etc.)
[Ye24]	Perform graph tasks	SEM (graph)	NL (e.g., a category)
[Ch24]	Create training data	STRUC (graph)	STRUC (training data)
[Ji23b]	Answer questions	STRUC (Diverse)	NL or STRUC (queries)
[FFK23]	Draw diagrams	NL	STRUC (JSON diagrams)
[He23]	Create math exercises	NL	STRUC (LaTeX math)
[He23]	Phrase math formulae	STRUC (LaTeX math)	NL
[He23]	Create drawings	NL	STRUC (TikZ code)
[Xi24]	Create documents	NL + STRUC (an example)	STRUC (like the example)
[La23]	Edit (not create) texts	NL	NL
exp1	Edit (not create) docs	SEM (LaTeX)	SEM (LaTeX)
exp2	Edit (not create) docs	STRUC (RIS)	STRUC (OPUS XML)
[Si23]	Transform tables	STRUC (Diverse)	STRUC (Diverse, e.g., csv, json)
[Bo24]	Find column types	STRUC (Table)	STRUC (json list)

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<https://doi.org/10.57688/303>

Prompts und Daten: https://github.com/weberi/2024_AKWI_structured_gpt_experiments

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