Mg Alloy Text Mining Tool

A Python Application for Automated Data Extraction and Analysis

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Outline:

- Background and Motivation
- Objectives
- Research question
- Methodology diagram
- Text mining application
- Demonstration
- Key achievements
- Future directions

- Magnesium (Mg) alloys are widely researched for their lightweight, high-strength properties, making them critical in industries such as aerospace, automotive, and biomedical engineering.
- Research data on Mg alloys is often dispersed across scientific publications, stored in unstructured formats, and challenging to process manually.

Motivation

- Manual extraction and cleaning of data from scientific articles are labor-intensive and prone to errors.
- The growing volume of scientific publications requires an automated and efficient solution for data extraction and analysis.

- The main objective of this research is to extract specific information intelligently from scientific articles.

- The specific information includes:
  - material compositions (wt%),
  - processing Methods and Parameters,
  - mechanical Properties and
  - Corrosion Properties.

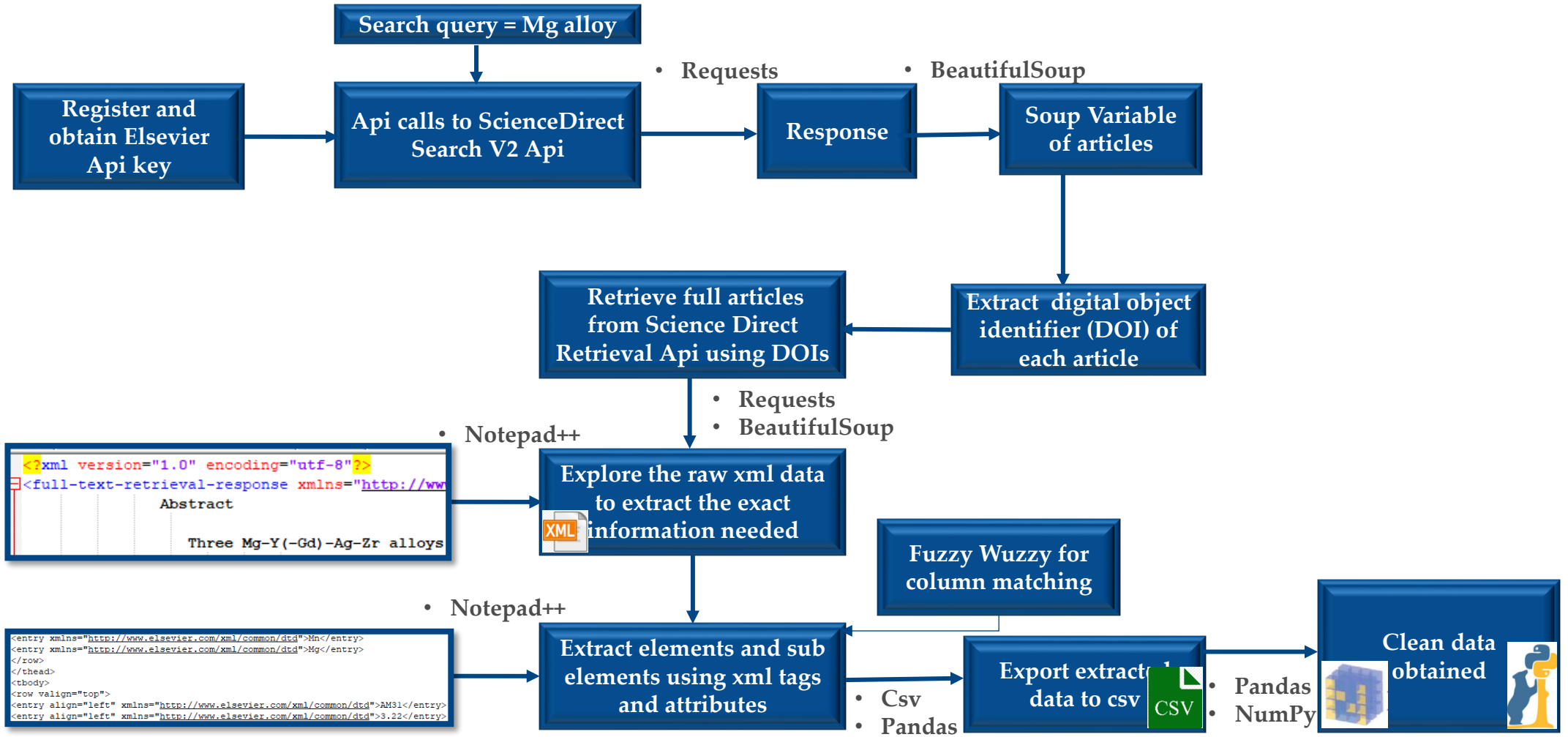
- Consolidate the extracted information into clean, comprehensive datasets for further material science research and analysis.

Research Question

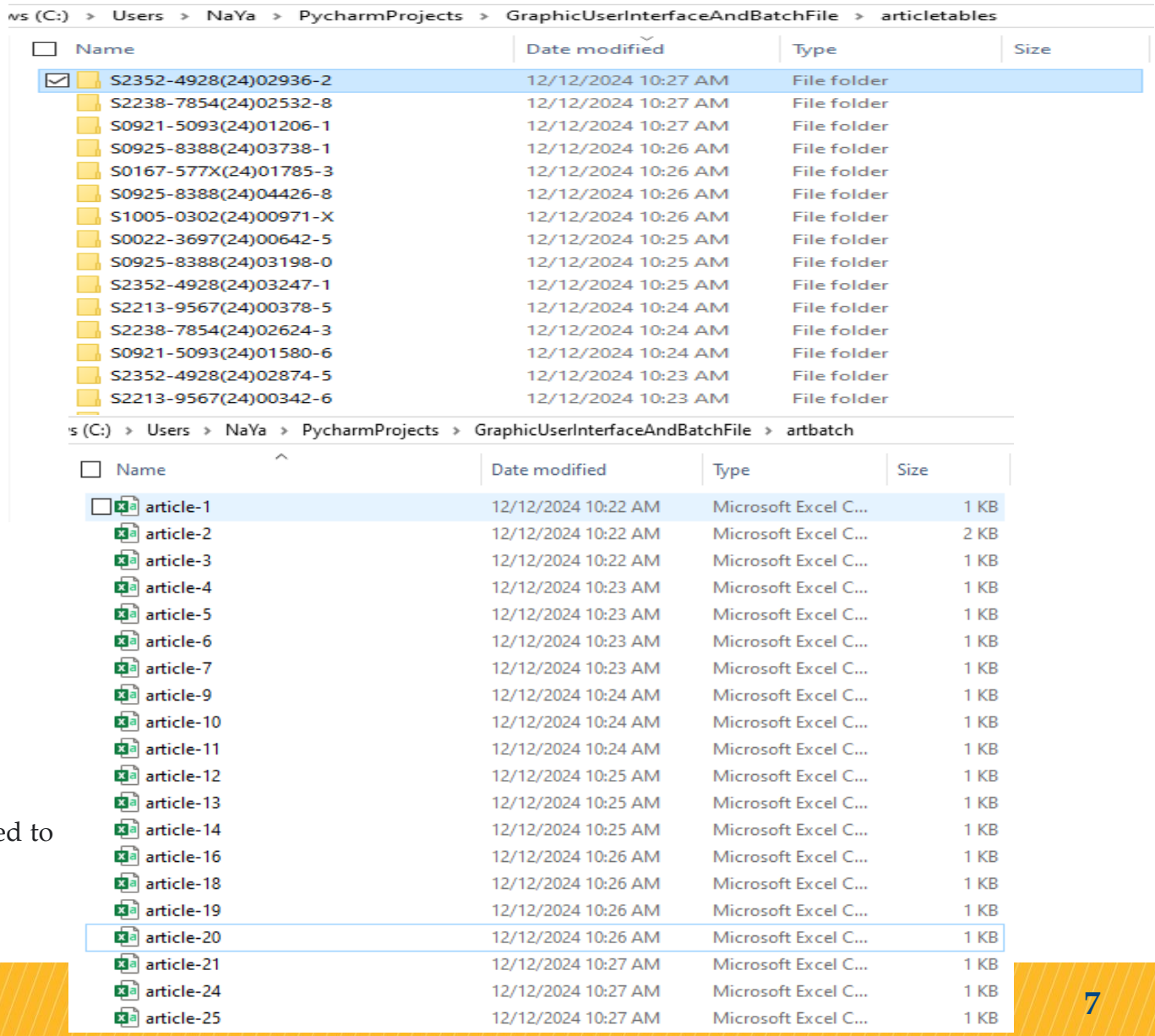
- How can we automate the extraction, processing, and analysis of large volumes of scientific data from unstructured and semi-structured sources, such as research articles, to enable efficient data-driven insights in material science, specifically for magnesium alloys?"

Title	Source (link)	Cooresponding Author	Nationality	Institute	Mateiral Con													Corrosion F	
																Compression			Immersion	
					Al	Ca	Zn	Mn	Sn	Li	Cu	Pb	Na	Zr	YS (MPa)	UCS (MPa)	E (%)	mg/mm^2h	mm/y
Phase equilibria, thermodynamics and solidification microstructures of Mg–Sn–Ca alloys, Part 1: Experimental investigation and thermodynamic modeling of the ternary Mg–Sn–Ca system	https://www.sciencedirect.com/science/article/pii/S0966979507002087?via%3Dihub	schmid-fetzer@tu-clausthal.de (R. Schmid-Fetzer).	Germany	Institute of Metallurgy, Clausthal University of Technology, Robert-Koch-Str		40.28			0.21										
						22.91			33.93										
						15.51			45.65										
						0.04			66.68										
						21.75			64.21										
						21.04			70.35										
						3.51			69.25										
						31.23			61.59										
Recent research and developments on wrought magnesium alloys	https://www.sciencedirect.com/science/article/pii/S2213956717300464	yuanding.huang@hzg.de (Y. Huang).	Germany	MagIC-Magnesium Innovation Centre, Helmholtz-Zentrum Geesthacht, Max-Planck-Str. 1	3.00	3.00		0.30							285	472	9.5		

Methodology Diagram



Mg Alloy Data Collection Applications



- **Digital Object Identifier (DOI)**, is a string of numbers, letters and symbols used to uniquely identify an article or document.
- The **Publisher Item Identifier (PII)** is a unique identifier used by a number of scientific journal publishers to identify documents.

Consolidated CVS file

Titles	DOI	Pii	Link	Authors	Al	Ca	Zn	Mn	Sn	Cu	Zr	Y	Gd	Mg	Si	Bi	As-cast	YS (MPa)	UTS (MP
Rationalizing Al-Mg, Al-I	10.1016/j.mt	S235249282	https://ap	Junsheng WangJiaqiang HanRuifeng DouDongxu ChenHoubing Huang															
Effect of Al on microstr	10.1016/j.pns	S100200711	https://ap	Shida MaAitao TangPeng PengGe	3.22			1.22						95.6				266	25
					5.8			0.92						93.28				280	27
					9.07			0.88						90.05				307	30
Tuning texture and prec	10.1016/j.ma	S104458032	https://ap	Yu ZhangWei RongYujuan WuLiming Peng															
A study of microstructu	10.1016/j.ms	S092150932	https://ap	Dan WangPenghuai FuLiming PengYingxin WangWenjiang Ding							0.4		9.49				Eutectic phase area ratio		
											0.35	0.96	8.86				86 µm	222	
																	78 µm	233	
Effects of Si content an	10.1016/j.ma	S025405842	https://ap	Tian GuoShusen WuXiong ZhouShulin LüLanc		0									0.91				
						0									2.13				
						0									2.92				
						0									4.14				
						0.18									4.17				
						0.44									3.96				
						0.62									3.89				
						0.77									3.95				
						1.05									4.13				
Achieving ultra-high stre	10.1016/j.jms	S100503022	https://ap	Yu ZhangWei RongYujuan WuLiming Peng															
Assessment of atomic n	10.1016/j.jms	S100503022	https://ap	Yuhui ZhangYuling LiuShuhong LiuHai-Lin ChenYong Du															
New Mg-Ca-Zn amorph	10.1016/j.mtl	S258915292	https://ap	Sudeep PaulParthiban RamasamyMitun DasDurbadal MandalSupriya Bera															
Fabrication of high-stre	10.1016/j.ma	S104458032	https://ap	Qingchen DengYujuan WuYuanhang LuoNing SuLiming Peng															
Investigation of the allo	10.1016/j.jma	S221395672	https://ap	Alireza MaldarLeyun WangGaoming ZhuXiaoqin Zeng														90	18
																		83	21
																		148	22

- Above picture shows Titles, doi's, pii's, link, Authors and Tables of the 25 articles exported to csv with the

Automation:

Eliminates the need for manual data extraction by integrating with Elsevier's API and automating metadata and table retrieval.

Scalability:

Capable of processing large volumes of articles and combining information into a single, analyzable dataset.

User-Friendliness:

Provides a graphical user interface (GUI) that simplifies the data retrieval and processing pipeline for non-technical users.

Demonstration Video

- Expand to Other Domains:
  - Adapt the tool for use with other material types or scientific fields.
- Enhanced NLP Integration:
  - Incorporate more sophisticated natural language processing techniques for semantic understanding of content beyond tables.
  - Intelligent column matching.
- Visualization:
  - Add data visualization features to generate insights directly within the tool.