Dominance and Diversity in Artificial Intelligence Research:

A Scientometric Analysis of National Trends across Subdisciplines

Master Thesis

Digital Humanities

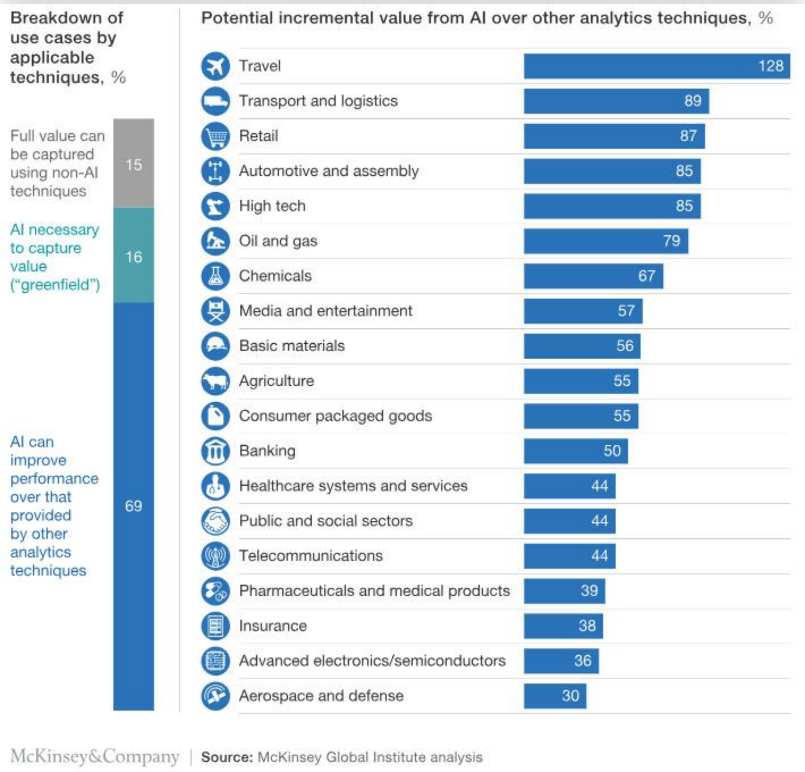
UNIVERSITÄT LEIPZIG

Julius Pfundstein

AI has become a central resource of geoeconomic power

PWC estimates AI will add 17 trillion USD to the global economy by 2030

Applicable across the entire value chain



UNDIR considers AI (Automated Weaponry; Cyber-Security; Intelligence) to be indispensible in modern warfare

by now most governments have an official AI-roadmap

EU27 200 Billion Ivestment Strategy

European Commission - Press release

EU launches InvestAI initiative to mobilise €200 billion of investment in artificial intelligence*

Paris, 11 February 2025

Today, at the Artificial Intelligence (AI) Action Summit in Paris, Commission President Ursula **von der Leyen** has launched **InvestAI, an initiative to mobilise €200 billion for investment in AI, including a new European fund of €20 billion for AI gigafactories**. This **large AI infrastructure** is needed to allow open, collaborative development of the most complex AI models and to make Europe an AI continent.

Commission President Ursula **von der Leyen** said: *"AI will improve our healthcare, spur our research and innovation and boost our competitiveness. We want AI to be a force for good and for growth. We are doing this through our own European approach – based on openness, cooperation and excellent talent. But our approach still needs to be supercharged. This is why, together with our Member States and with our partners, we will mobilise unprecedented capital through InvestAI for European AI gigafactories. This unique public-private partnership, akin to a CERN for AI, will enable all our scientists and companies – not just the biggest - to develop the most advanced very large models needed to make Europe an AI continent."*

President of the European Investment Bank, Nadia Calviño, said: *"Together with the EU Commission, the EIB Group is stepping up support for Artificial Intelligence, a key driver of innovation and productivity in Europe."*

The EU's InvestAI fund will finance four future AI gigafactories across the EU. The new AI gigafactories will be specialised in training the most complex, very large, AI models. Such next-generation models require extensive computing infrastructure for breakthroughs in specific domains such as medicine or science. The gigafactories will have around 100 000 latest-generation AI chips, around four times more than the AI factories being set up right now.

The gigafactories funded through InvestAI will be the largest public-private partnership in the world for the development of trustworthy AI. They will serve the European model of cooperative, open innovation, with a focus on complex industrial and mission-critical applications. The goal is that every company, not only the biggest players, can access large-scale computing power to build the future.

InvestAI will include a layered fund, with shares of different risk and return profiles. The EU budget would derisk the investment of other partners. The Commission's initial funding for InvestAI will come from existing EU funding programmes which have a digital component, such as Digital Europe Programme and Horizon Europe, and InvestEU. Member States can also contribute by programming funds from their Cohesion envelopes. Funding of AI gigafactories with a mix of grants and equity will serve as one of the pilot cases for strategic technologies announced in the Competitiveness Compass.

The Commission has already announced the initial seven AI factories in December and will soon announce the next five. The existing support for AI Factories of €10 billion, co-financed by the EU and the Member States, is already the largest public investment in AI in the world, and will unlock over ten times more private investment. It already provides massive access for start-ups and industry to supercomputers.

Background

Next to the InvestAI fund launched today, the Commission is taking many actions in different fields to support AI innovation in Europe. AI Factories are a highlight of the Commission's AI innovation package presented in January 2024, together with:

- **Financial support** through Horizon Europe and the Digital Europe programme dedicated to

US 500 Billion investment in AI & Semiconductors

Rise of the Machines

Artificial Intelligence and its Growing Impact on U.S. Policy

Chairman Will Hurd and Ranking Member Robin Kelly

Subcommittee on Information Technology

Committee on Oversight and Government Reform

U.S. House of Representatives

September 2018

China 1.86 Trillion for 10 industries (including AI)

CAICT 中国信通院

No. 202205

Artificial Intelligence White Paper

(2022)

China Academy of Information and Communications Technology

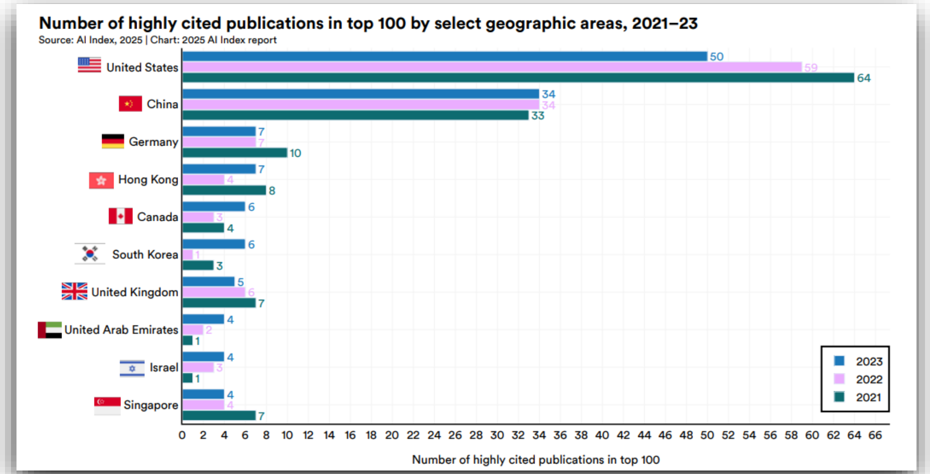
(CAICT)

April 2022

research is undercomplex in two ways

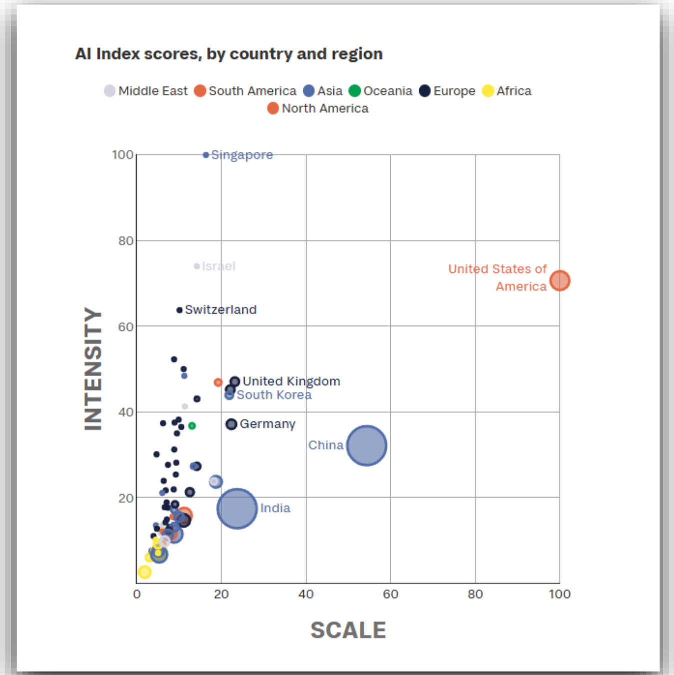
AI is considered as a singular Discipline

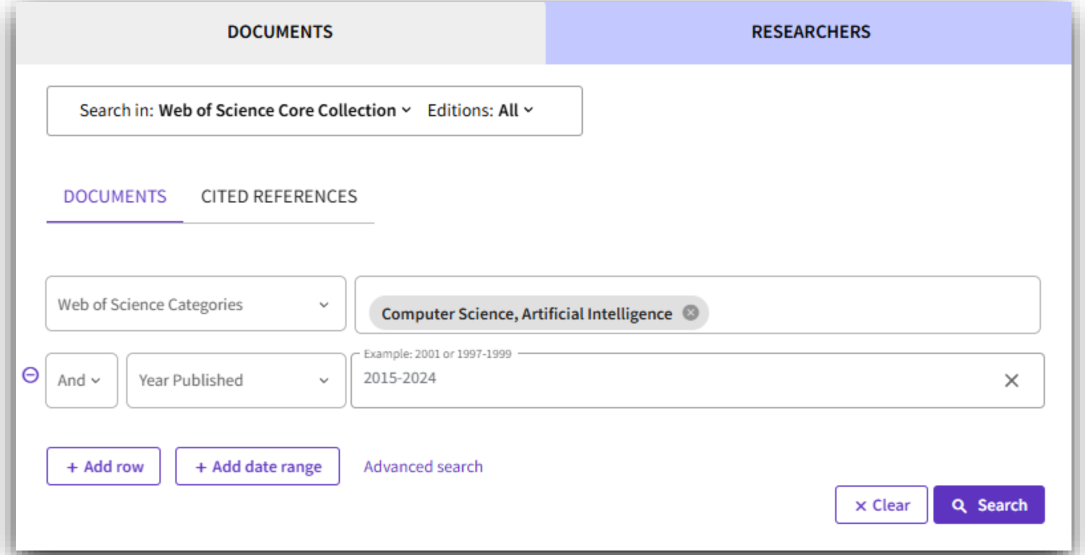
Artificial Intelligence Index Report 2025
Standford University Human-Centered Artificial Intelligence



No distinction of Institutions (or institutional types) within countries

The Global Artificial Intelligence Index 2024
Tortoisemedia

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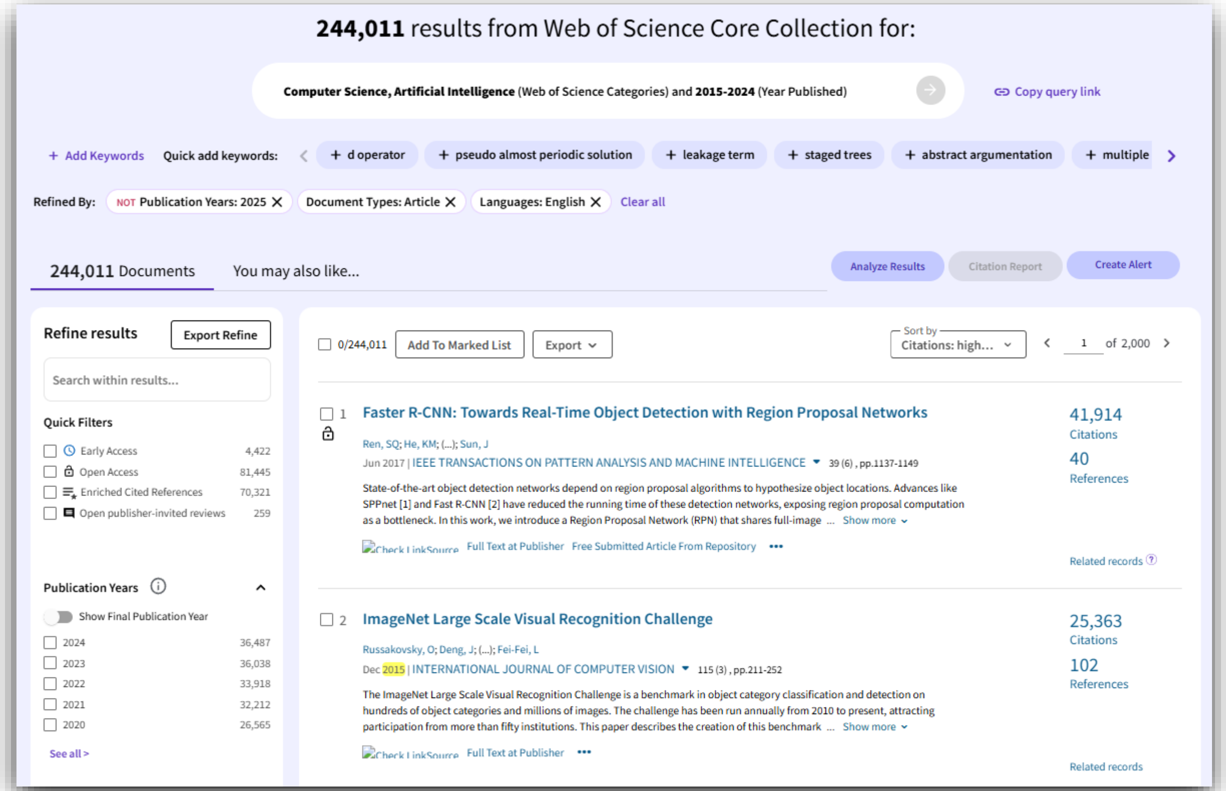
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Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks
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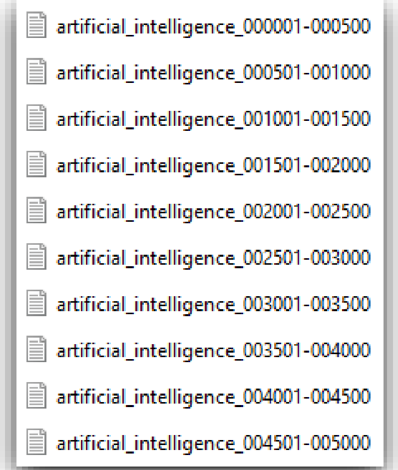
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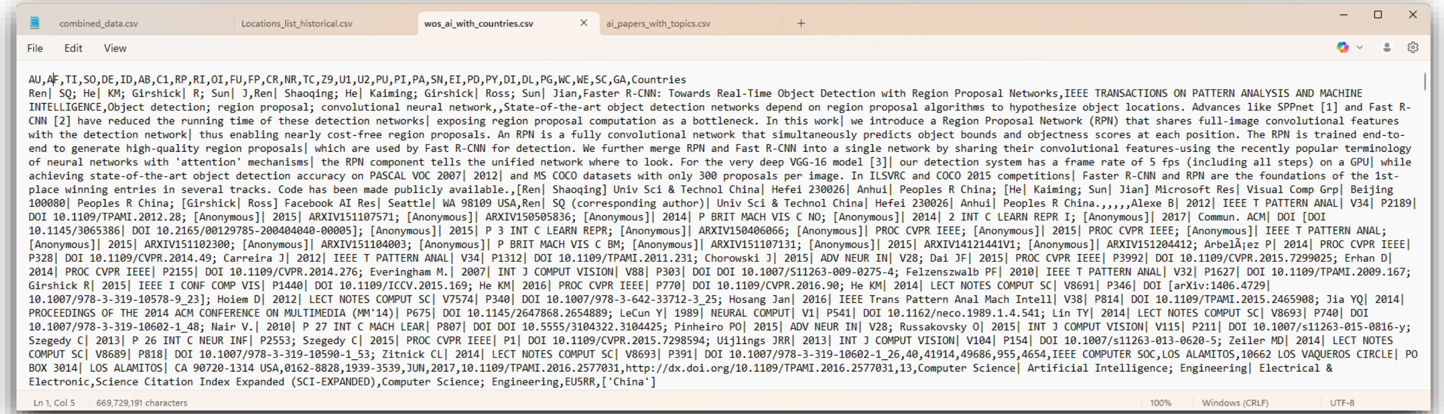
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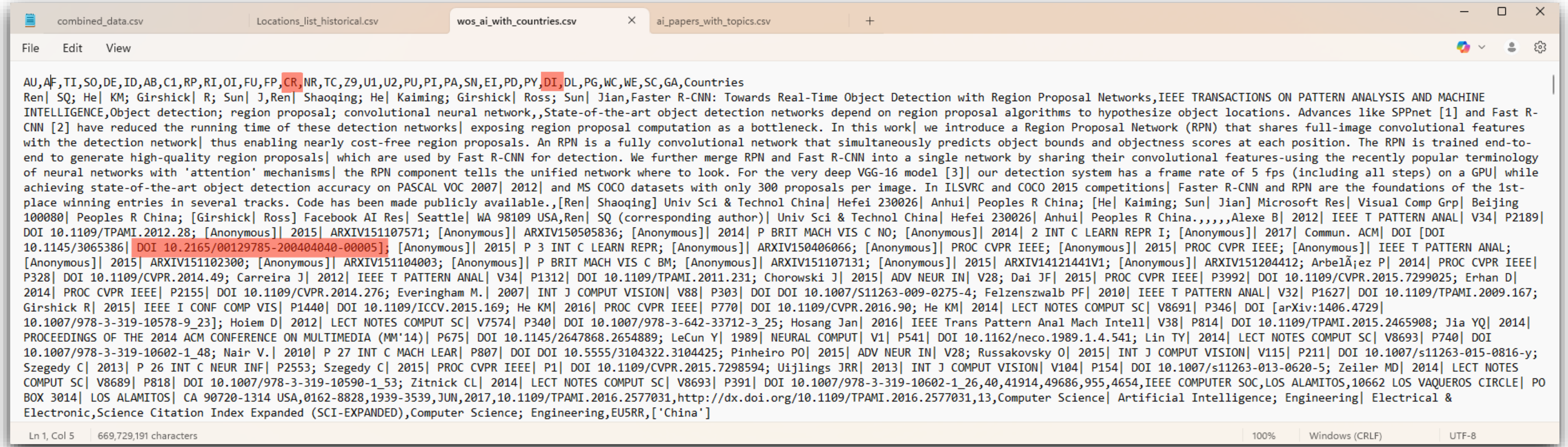
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Ren| SQ; He| KM; Girshick| R; Sun| J,Ren| Shaoqing; He| Kaiming; Girshick| Ross; Sun| Jian,Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks,IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE,Object detection; region proposal; convolutional neural network,,State-of-the-art object detection networks depend on region proposal algorithms to hypothesize object locations. Advances like SPPnet [1] and Fast R-CNN [2] have reduced the running time of these detection networks| exposing region proposal computation as a bottleneck. In this work| we introduce a Region Proposal Network (RPN) that shares full-image convolutional features with the detection network| thus enabling nearly cost-free region proposals. An RPN is a fully convolutional network that simultaneously predicts object bounds and objectness scores at each position. The RPN is trained end-to-end to generate high-quality region proposals| which are used by Fast R-CNN for detection. We further merge RPN and Fast R-CNN into a single network by sharing their convolutional features-using the recently popular terminology of neural networks with 'attention' mechanisms| the RPN component tells the unified network where to look. For the very deep VGG-16 model [3]| our detection system has a frame rate of 5 fps (including all steps) on a GPU| while achieving state-of-the-art object detection accuracy on PASCAL VOC 2007| 2012| and MS COCO datasets with only 300 proposals per image. In ILSVRC and COCO 2015 competitions| Faster R-CNN and RPN are the foundations of the 1st-place winning entries in several tracks. Code has been made publicly available.,[Ren| Shaoqing] Univ Sci & Technol China| Hefei 230026| Anhui| Peoples R China; [He| Kaiming; Sun| Jian] Microsoft Res| Visual Comp Grp| Beijing 100080| Peoples R China; [Girshick| Ross] Facebook AI Res| Seattle| WA 98109 USA,Ren| SQ (corresponding author)| Univ Sci & Technol China| Hefei 230026| Anhui| Peoples R China.,,,,,Alexe B| 2012| IEEE T PATTERN ANAL| V34| P2189| DOI 10.1109/TPAMI.2012.28; [Anonymous]| 2015| ARXIV151107571; [Anonymous]| ARXIV150505836; [Anonymous]| 2014| P BRIT MACH VIS C NO; [Anonymous]| 2014| 2 INT C LEARN REPR I; [Anonymous]| 2017| Commun. ACM| DOI [DOI 10.1145/3065386| DOI 10.2165/00129785-200404040-00005]; [Anonymous]| 2015| P 3 INT C LEARN REPR; [Anonymous]| ARXIV150406066; [Anonymous]| PROC CVPR IEEE; [Anonymous]| 2015| PROC CVPR IEEE; [Anonymous]| IEEE T PATTERN ANAL; [Anonymous]| 2015| ARXIV151102300; [Anonymous]| ARXIV151104003; [Anonymous]| P BRIT MACH VIS C BM; [Anonymous]| ARXIV151107131; [Anonymous]| 2015| ARXIV14121441V1; [Anonymous]| ARXIV151204412; ArbelÃ¡ez P| 2014| PROC CVPR IEEE| P328| DOI 10.1109/CVPR.2014.49; Carreira J| 2012| IEEE T PATTERN ANAL| V34| P1312| DOI 10.1109/TPAMI.2011.231; Chorowski J| 2015| ADV NEUR IN| V28; Dai JF| 2015| PROC CVPR IEEE| P3992| DOI 10.1109/CVPR.2015.7299025; Erhan D| 2014| PROC CVPR IEEE| P2155| DOI 10.1109/CVPR.2014.276; Everingham M.| 2007| INT J COMPUT VISION| V88| P303| DOI DOI 10.1007/S11263-009-0275-4; Felzenszwalb PF| 2010| IEEE T PATTERN ANAL| V32| P1627| DOI 10.1109/TPAMI.2009.167; Girshick R| 2015| IEEE I CONF COMP VIS| P1440| DOI 10.1109/ICCV.2015.169; He KM| 2016| PROC CVPR IEEE| P770| DOI 10.1109/CVPR.2016.90; He KM| 2014| LECT NOTES COMPUT SC| V8691| P346| DOI [arXiv:1406.4729| 10.1007/978-3-319-10578-9_23]; Hoiem D| 2012| LECT NOTES COMPUT SC| V7574| P340| DOI 10.1007/978-3-642-33712-3_25; Hosang Jan| 2016| IEEE Trans Pattern Anal Mach Intell| V38| P814| DOI 10.1109/TPAMI.2015.2465908; Jia YQ| 2014| PROCEEDINGS OF THE 2014 ACM CONFERENCE ON MULTIMEDIA (MM'14)| P675| DOI 10.1145/2647868.2654889; LeCun Y| 1989| NEURAL COMPUT| V1| P541| DOI 10.1162/neco.1989.1.4.541; Lin TY| 2014| LECT NOTES COMPUT SC| V8693| P740| DOI 10.1007/978-3-319-10602-1_48; Nair V.| 2010| P 27 INT C MACH LEAR| P807| DOI DOI 10.5555/3104322.3104425; Pinheiro PO| 2015| ADV NEUR IN| V28; Russakovsky O| 2015| INT J COMPUT VISION| V115| P211| DOI 10.1007/s11263-015-0816-y; Szegedy C| 2013| P 26 INT C NEUR INF| P2553; Szegedy C| 2015| PROC CVPR IEEE| P1| DOI 10.1109/CVPR.2015.7298594; Uijlings JRR| 2013| INT J COMPUT VISION| V104| P154| DOI 10.1007/s11263-013-0620-5; Zeiler MD| 2014| LECT NOTES COMPUT SC| V8689| P818| DOI 10.1007/978-3-319-10590-1_53; Zitnick CL| 2014| LECT NOTES COMPUT SC| V8693| P391| DOI 10.1007/978-3-319-10602-1_26,40,41914,49686,955,4654,IEEE COMPUTER SOC,LOS ALAMITOS,10662 LOS VAQUEROS CIRCLE| PO BOX 3014| LOS ALAMITOS| CA 90720-1314 USA,0162-8828,1939-3539,JUN,2017,10.1109/TPAMI.2016.2577031,http://dx.doi.org/10.1109/TPAMI.2016.2577031,13,Computer Science| Artificial Intelligence; Engineering| Electrical & Electronic,Science Citation Index Expanded (SCI-EXPANDED),Computer Science; Engineering,EU5RR,['China']
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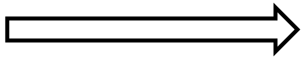

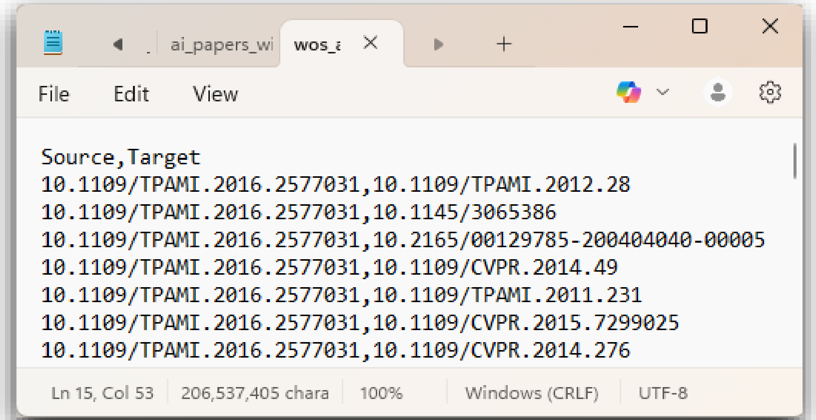
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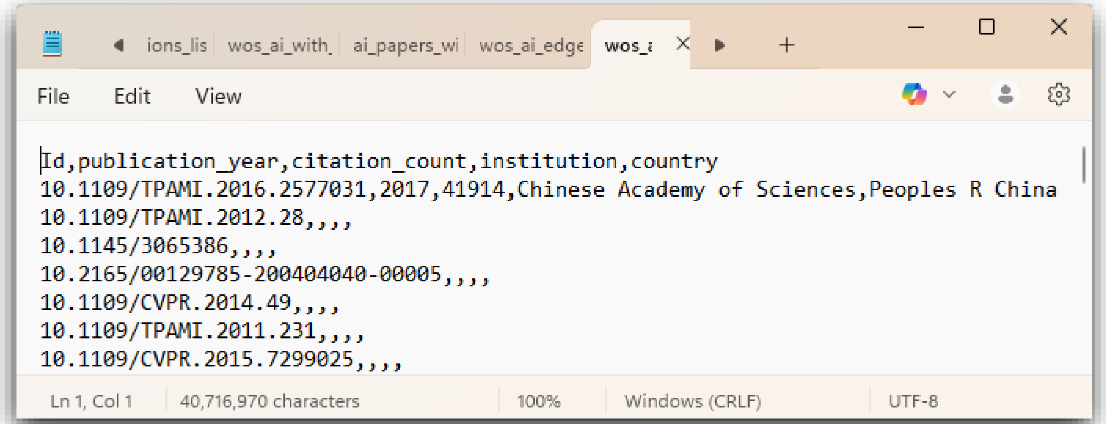
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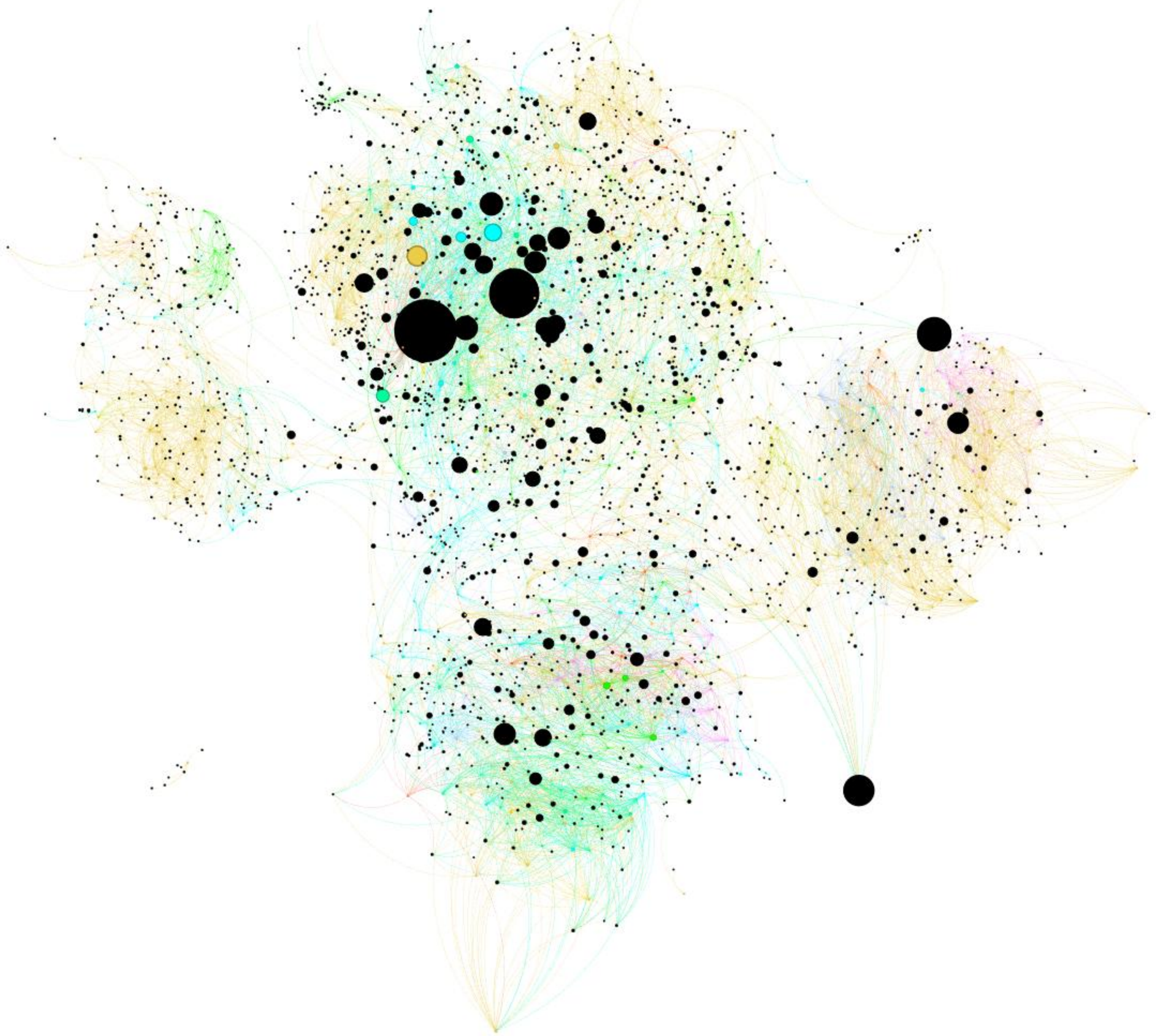
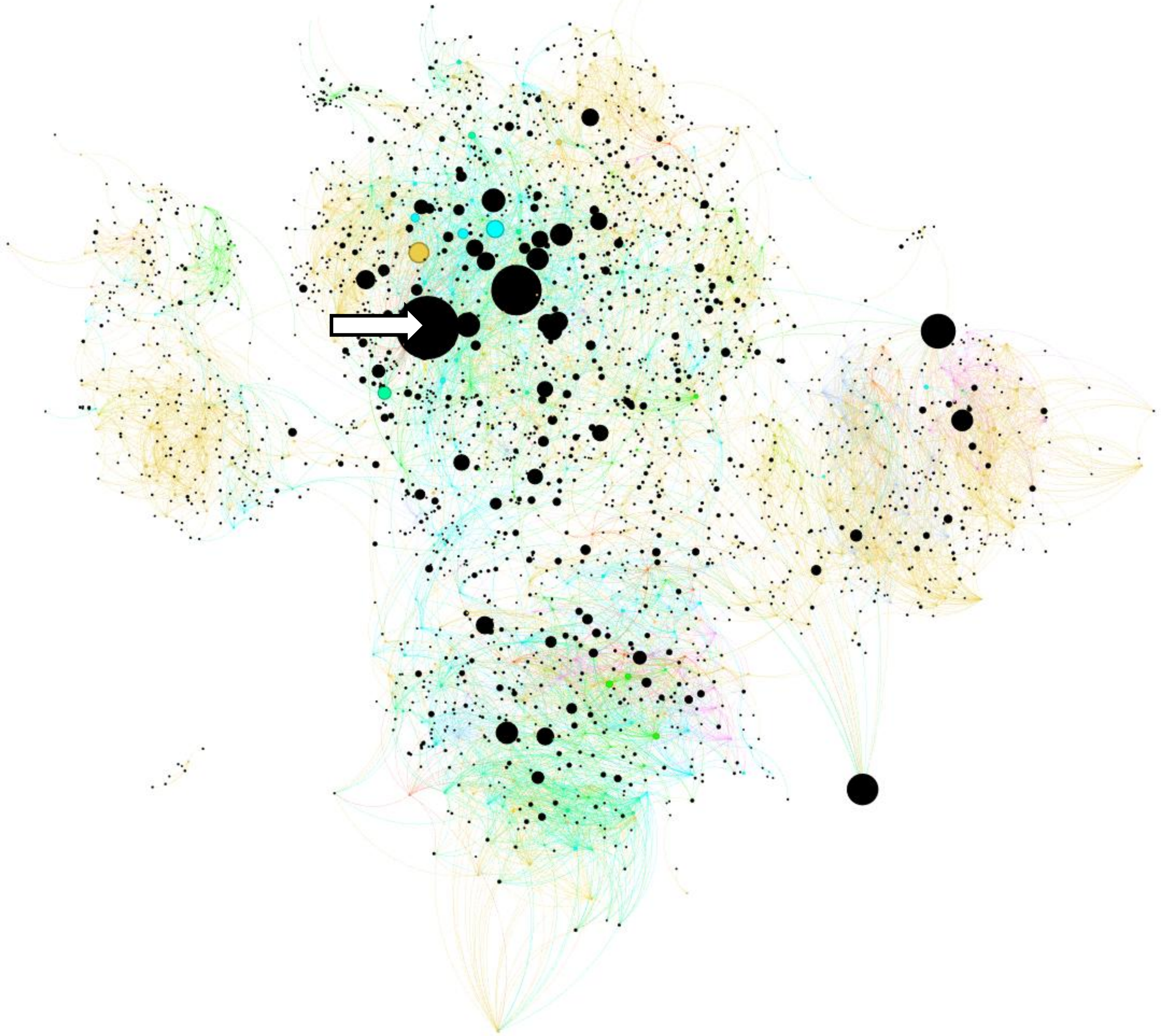


Gephi

- Node size displays eigenvector centrality
- Edge color displays country of origin of referencing country
- Filtered to contain only nodes with eigenvector centrality bigger than 1 percent of the biggest (index) and all edges between remaining nodes



Gephi

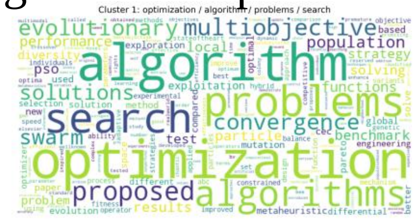
- Node size displays eigenvector centrality
- Edge color displays country of origin of referencing country
- Filtered to contain only nodes with eigenvector centrality bigger than 1 percent of the biggest (index) and all edges between remaining nodes

Deep Residual Learning for Image Recognition: A Survey

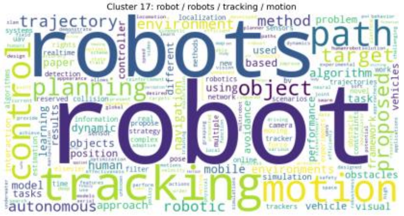
By Are you this author?	Shafiq, M (Shafiq, Muhammad) [1] ; Gu, ZQ (Gu, Zhaoquan) [2] , [3] View Web of Science ResearcherID and ORCID (provided by Clarivate)
Source	APPLIED SCIENCES-BASEL Volume: 12 Issue: 18 DOI: 10.3390/app12188972
Article Number	8972
Published	SEP 2022
Indexed	2022-09-30
Document Type	Review
Abstract	Deep Residual Networks have recently been shown to significantly improve the performance of neural networks trained on ImageNet, with results beating all previous methods on this dataset by large margins in the image classification task. However, the meaning of these impressive numbers and their implications for future research are not fully understood yet. In this survey, we will try to explain what Deep Residual Networks are, how they achieve their excellent results, and why their successful implementation in practice represents a significant advance over existing techniques. We also discuss some open questions related to residual learning as well as possible applications of Deep Residual Networks beyond ImageNet. Finally, we discuss some issues that still need to be resolved before deep residual learning can be applied on more complex problems.
Keywords	**Author Keywords:** deep residual learning for image recognition; deep residual learning; image processing; image recognition **Keywords Plus:** AUTOMATED-SYSTEM; IDENTIFICATION; NORMALIZATION; NETWORK; CNN

Web of Science Categories	Chemistry, Multidisciplinary; Engineering, Multidisciplinary; Materials Science, Multidisciplinary; Physics, Applied

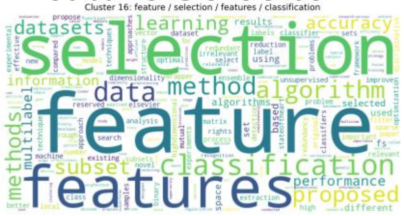
Algorithmic Optimization



Robotics

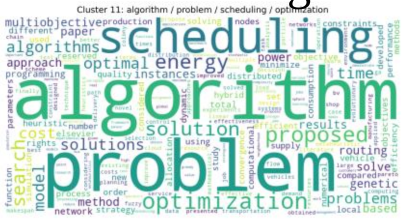


Feature Seleciton



Recommendation System

Scheduling



Medical Analytics

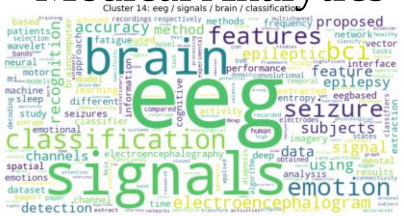
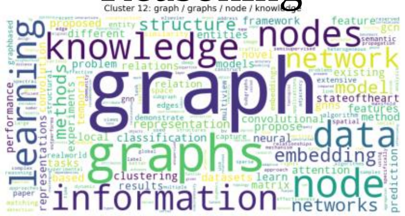
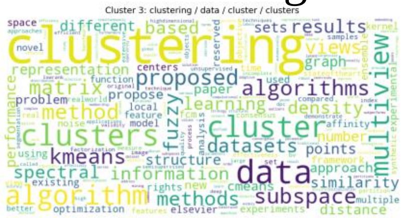


Image Recognition

Reasoning

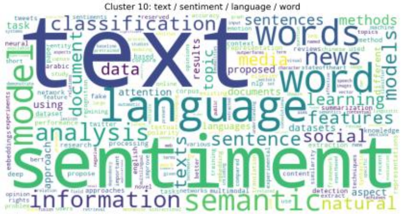


Clustering



Diagnosis

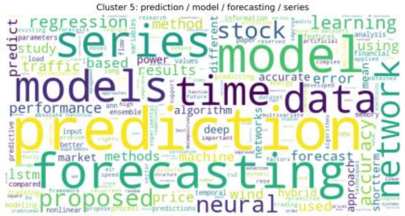
Sentiment Analysis



NLP

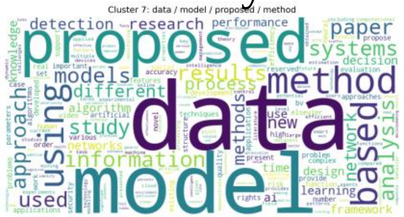
Classification

Prediction

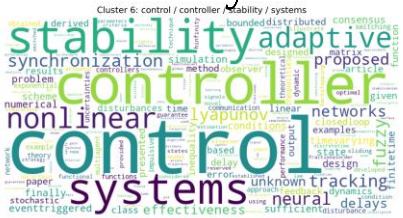


Face Recognition

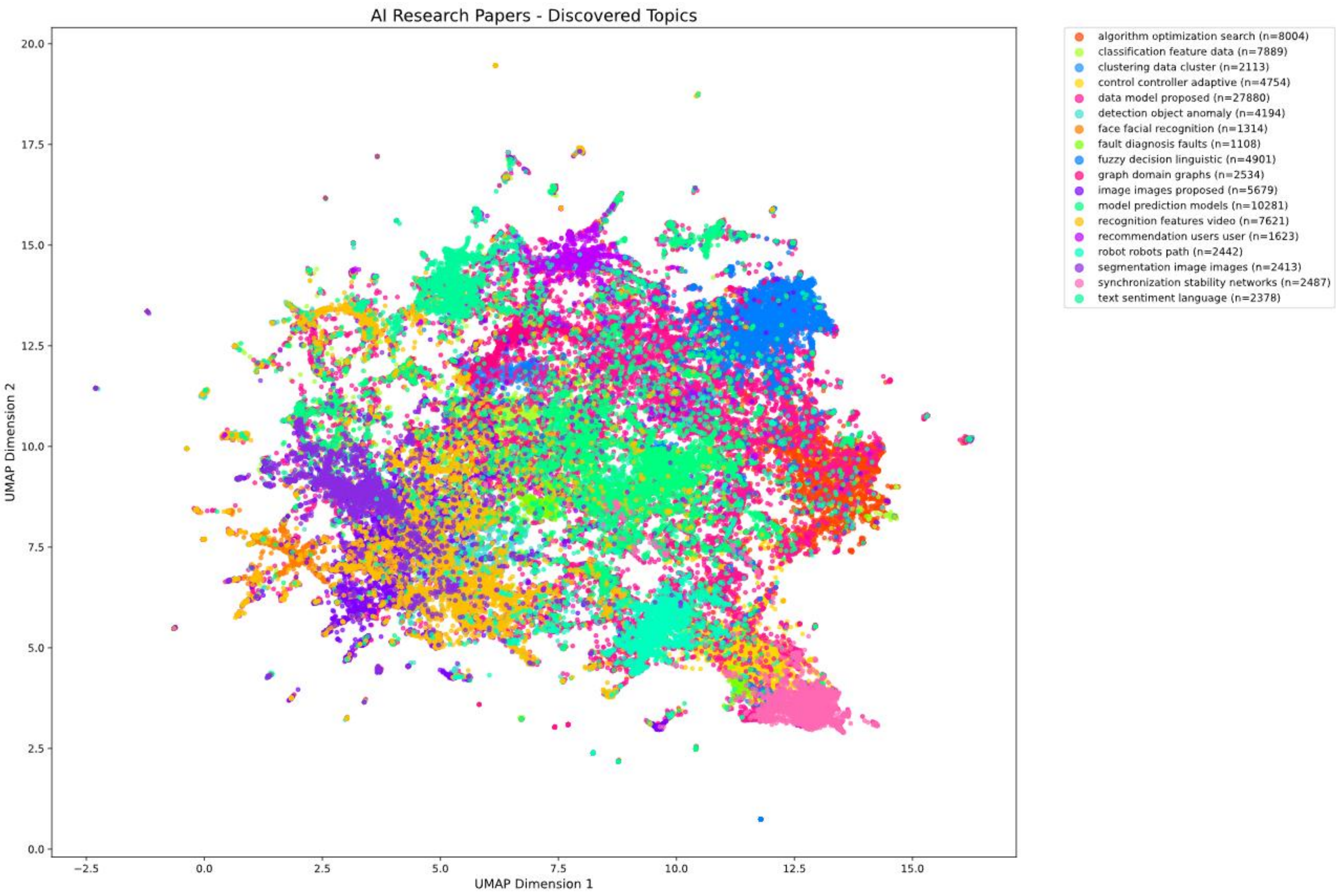
Data Analysis



Control Systems



Method: typical text preprocessing; removal of most and least used words; TfidfVectorization; Silhoutte Score for optimal Cluster size (arbitrary between 12 and 20); K-Means



AI Research Papers - Discovered Topics
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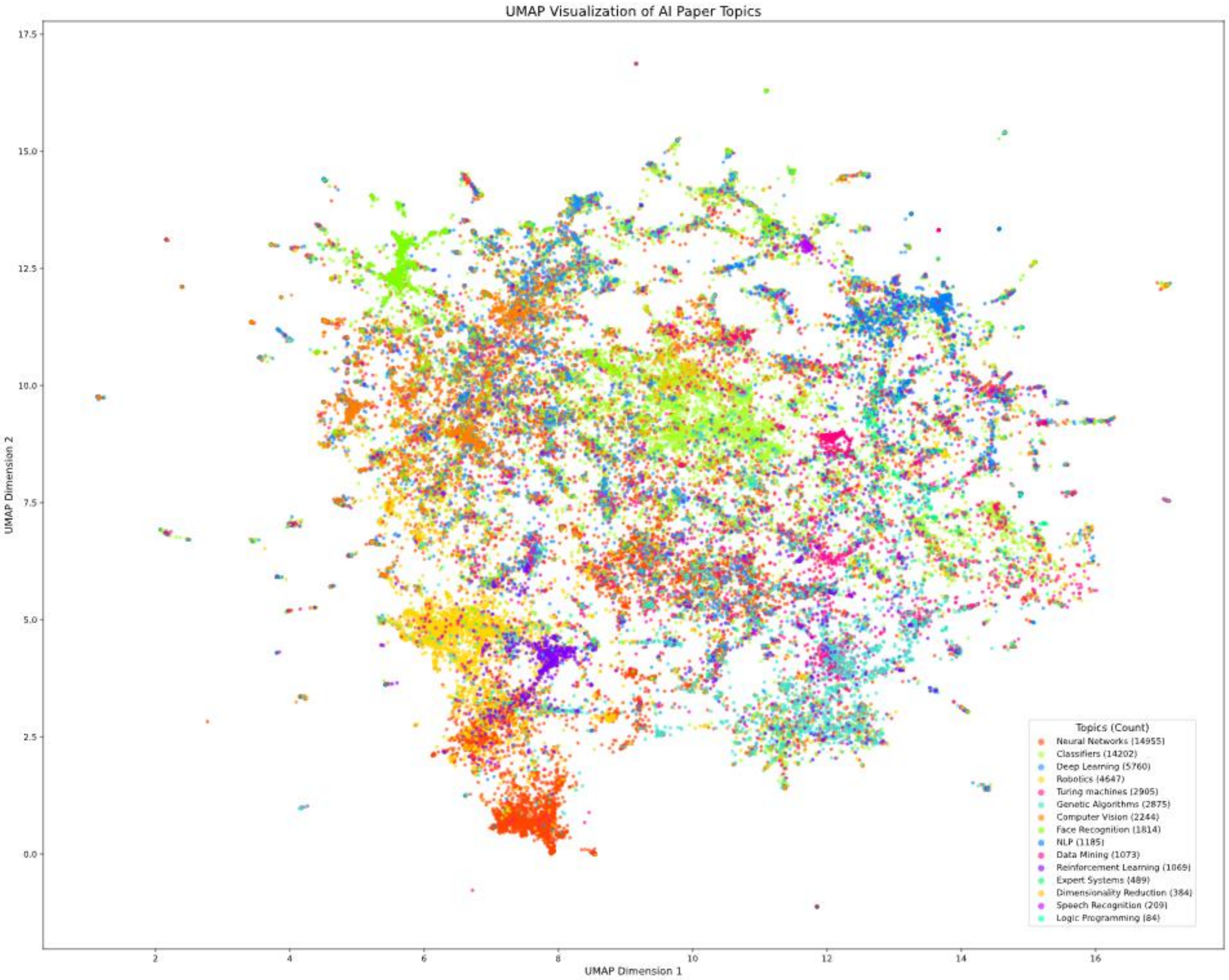
classification feature data (n=7889)
clustering data cluster (n=2113)
control controller adaptive (n=4754)
data model proposed (n=27880)
detection object anomaly (n=4194)
face facial recognition (n=1314)
fault diagnosis faults (n=1108)
fuzzy decision linguistic (n=4901)
graph domain graphs (n=2534)
image images proposed (n=5679)
model prediction models (n=10281)
recognition features video (n=7621)
recommendation users user (n=1623)
robot robots path (n=2442)
segmentation image images (n=2413)
synchronization stability networks (n=2487)
text sentiment language (n=2378)



research goal

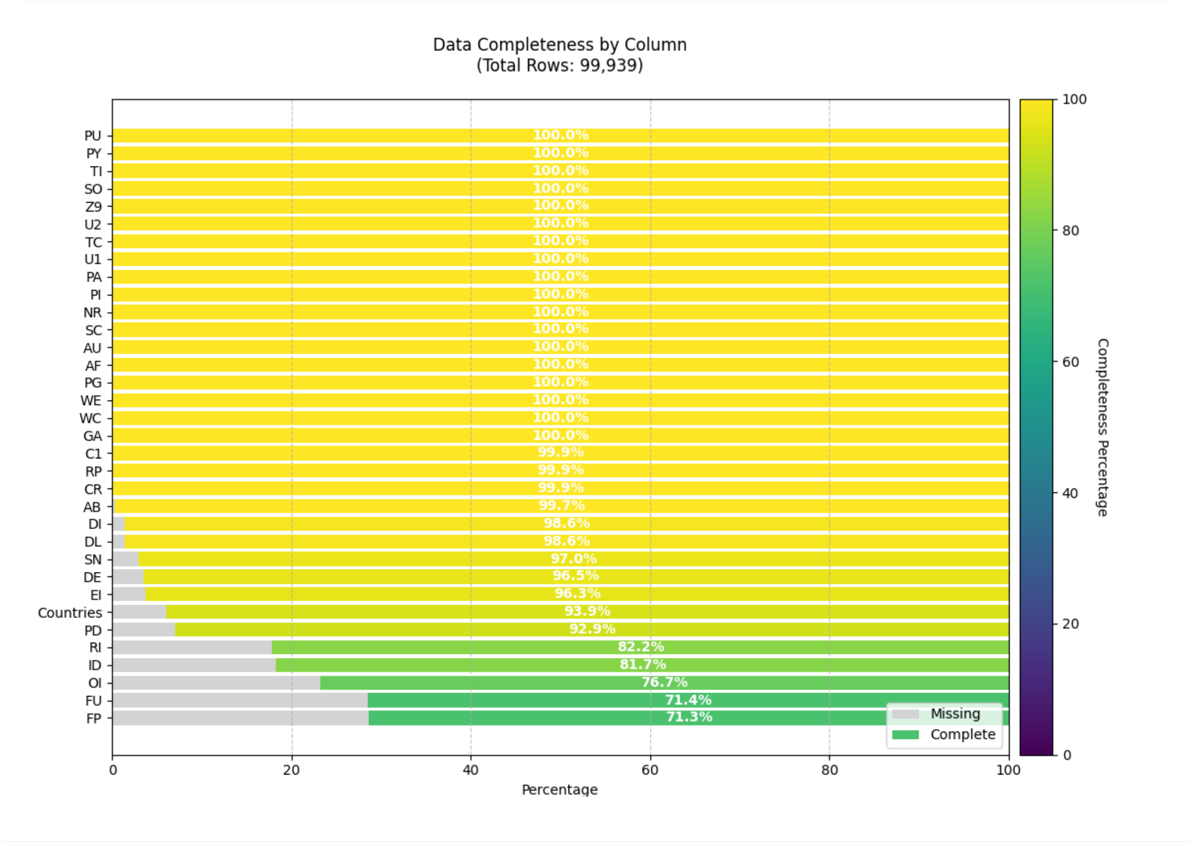
locate countries and institutional types within this projection

add timeline to analyse research trends

combine research impact and semantic position

problems

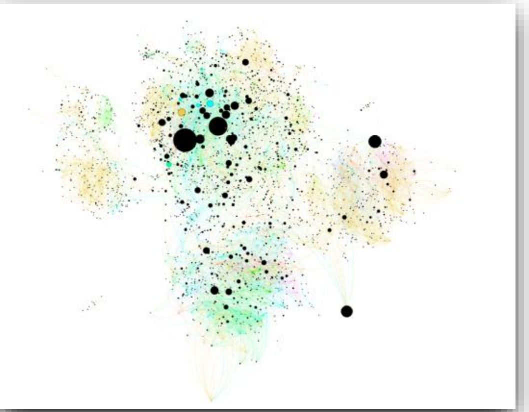
Missing Values (DOI; Country; Funding; ORCID)



Author disambiguation (missing ORCID)

Lee, DK
Lee, E; Park, Y; Shin, JG
Lee, JK; Lee, KJ; Park, HK; Hong, JS; Lee, JS
Lee, KJ; Lee, JK; Choi, SY
Lee, KR
Lee, SJ; Woo, JH; Shin, JG
Lee, YG; Ju, S; Woo, JH

WoS Categories



possible solutions?

Author disambiguation (missing ORCID)

Lee, DK
Lee, E; Park, Y; Shin, JG
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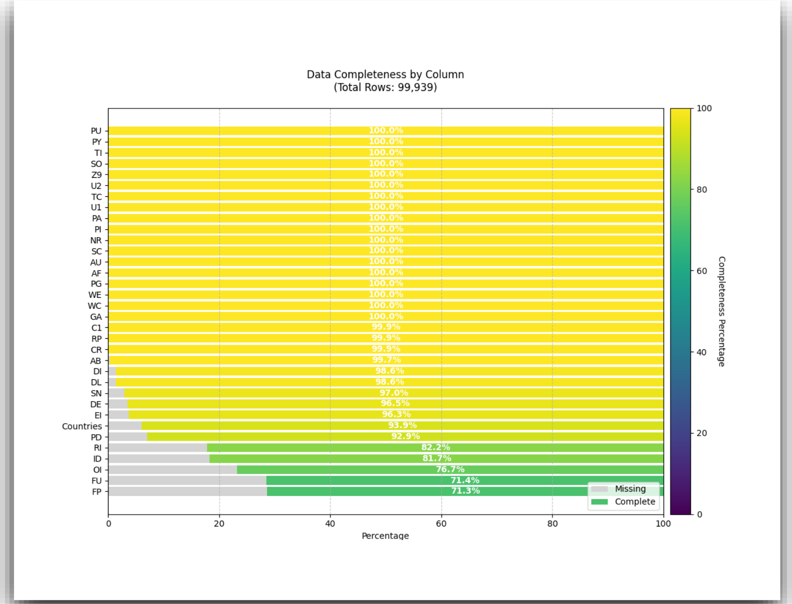
Lee, KJ; Lee, JK; Choi, SY
Lee, KR
Lee, SJ; Woo, JH; Shin, JG
Lee, YG; Ju, S; Woo, JH

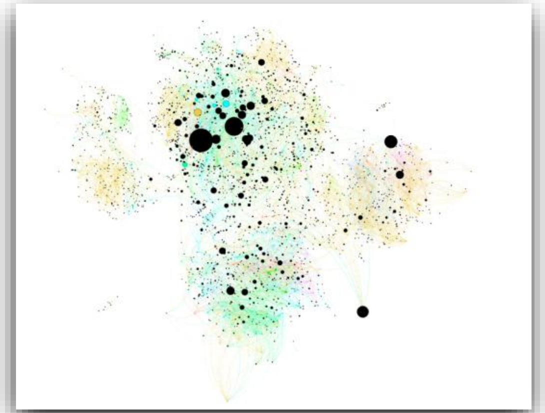
Matching with institution or field of research

Missing Values (DOI; Country; Funding; ORCID)



Create dictionary with institutions, that contains infromation about, country of origin, type (corporate; university, etc.)

WoS Categories



Use Keyword Search instead of categories; take everything and then filter according to abstract

(((((((((((((ALL=(neural network)) OR ALL=(classifier)) OR ALL=(deep learning)) OR ALL=(robotics)) OR ALL=(turing machine)) OR ALL=(genetic algorithms)) OR ALL=(computer vision)) OR ALL=(face recognition)) OR ALL=(natural language processing)) OR ALL=(data mining)) OR ALL=(reinforcement learning)) OR ALL=(expert system)) OR ALL=(dimensionality reduction)) OR ALL=(speech recognition))

1,189,379 results

thanks!