# Comparative Analysis of Machine Learning Citation Networks with Other Disciplines

## Context & Motivation

**Citation networks**: a widely studied social network type
- Intellectual interest: understand disciplines' evolution
- Practical interest: estimate authors' & papers' influence

Recently:
- Rapid development of **Machine Learning (ML)** & industry lab involvement

**Our work**:
- How does the citation networks of ML evolve & compare to other disciplines?
- Dataset: unarXive [1], 1.9M papers from 1991-2022, 8 main disciplines
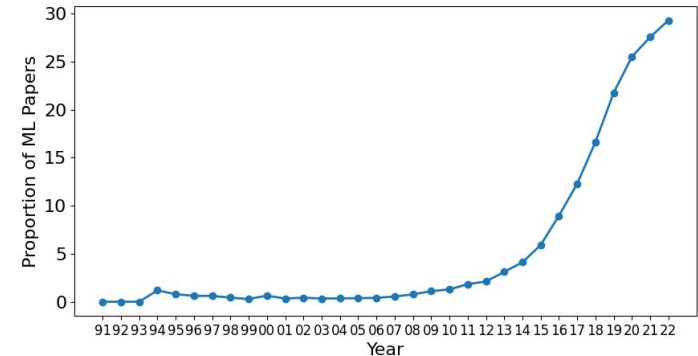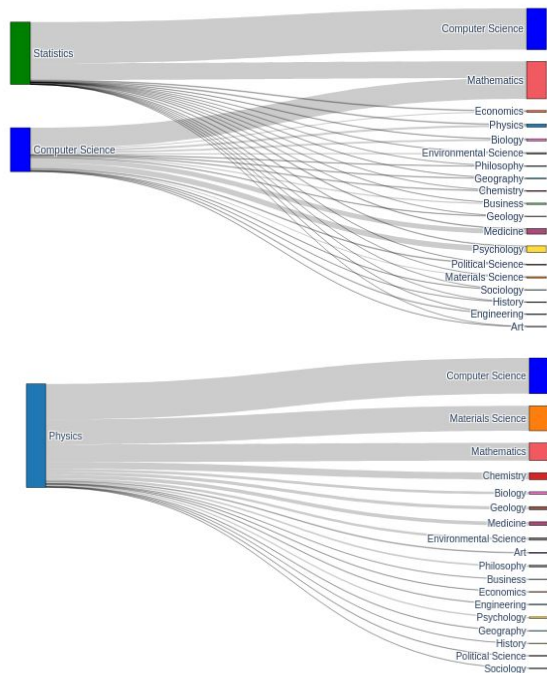


Table: Evolution of the proportion of ML papers from 1991 to 2022 in the arXiv papers

[1] Saier, T., Krause, J., & Färber, M. (2023). unarxive 2022: All arxiv publications pre-processed for nlp, including structured full-text and citation network. arXiv preprint

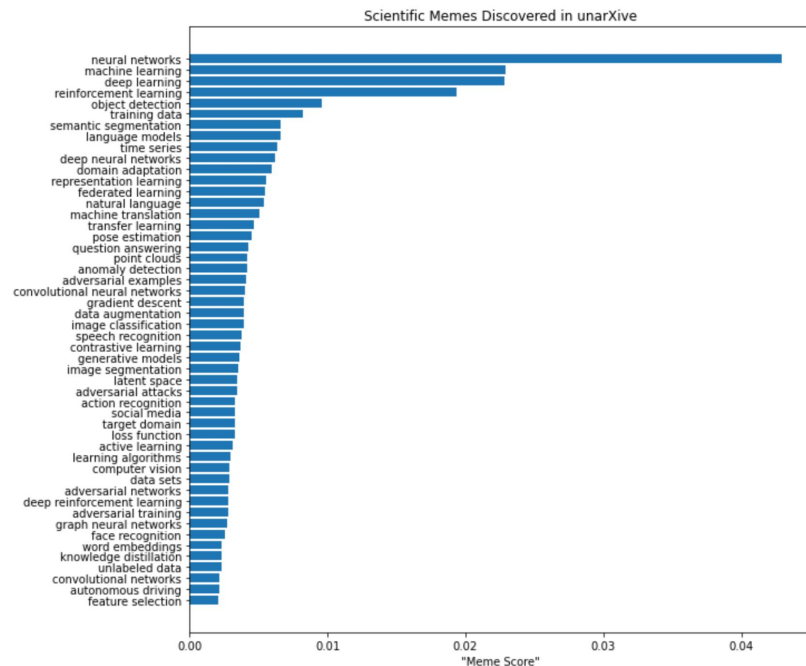Group: Madhav Aggarwal, Mustafa Omer Gul, Anne Wu

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## Preliminary findings

Comparison of the interdisciplinary degree of ML vs. Physics papers in 2022 (top: ML; bottom: Physics)

Leveraging network structure and n-grams to detect scientific memes



[2] Tobias Kuhn, Matjaž Perc, and Dirk Helbing. Inheritance patterns in citation networks reveal scientific memes. Physical Review X, 4(4):041036, 2014

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**Table with the stats for the proportion of ML papers**
**Categories taken into consideration: ["cs.AI", "cs.CL", "cs.CV", "cs.LG", "stat.ML"]**

## Total nb of papers/year

| | Year | Proportion | MLPapersCount | NbPapersNoCategories | TotalPapersCount |
|---|---|---|---|---|---|
| 0 | 91 | 0.000000 | 0 | 0 | 105 |
| 1 | 92 | 0.000000 | 0 | 0 | 1583 |
| 2 | 93 | 0.000000 | 0 | 0 | 3996 |
| 3 | 94 | 0.011781 | 76 | 0 | 6451 |
| 4 | 95 | 0.007837 | 69 | 0 | 8804 |
| 5 | 96 | 0.006108 | 80 | 1 | 13097 |
| 6 | 97 | 0.006037 | 104 | 0 | 17226 |
| 7 | 98 | 0.004237 | 91 | 0 | 21479 |
| 8 | 99 | 0.002813 | 70 | 0 | 24883 |
| 9 | 00 | 0.006307 | 173 | 0 | 27431 |
| 10 | 01 | 0.003336 | 99 | 0 | 29674 |
| 11 | 02 | 0.004164 | 134 | 0 | 32182 |
| 12 | 03 | 0.003323 | 116 | 0 | 34907 |
| 13 | 04 | 0.003522 | 135 | 0 | 38328 |
| 14 | 05 | 0.003650 | 148 | 0 | 40548 |
| 15 | 06 | 0.004054 | 176 | 0 | 43418 |
| 16 | 07 | 0.005384 | 257 | 0 | 47737 |

| | Year | Proportion | MLPapersCount | NbPapersNoCategories | TotalPapersCount |
|---|---|---|---|---|---|
| 17 | 08 | 0.007680 | 388 | 0 | 50523 |
| 18 | 09 | 0.010977 | 604 | 0 | 55026 |
| 19 | 10 | 0.012827 | 763 | 0 | 59482 |
| 20 | 11 | 0.018272 | 1203 | 0 | 65840 |
| 21 | 12 | 0.021095 | 1499 | 0 | 71059 |
| 22 | 13 | 0.031034 | 2425 | 0 | 78139 |
| 23 | 14 | 0.041067 | 3416 | 0 | 83182 |
| 24 | 15 | 0.059066 | 5373 | 0 | 90966 |
| 25 | 16 | 0.089552 | 8780 | 0 | 98044 |
| 26 | 17 | 0.122862 | 13165 | 0 | 107153 |
| 27 | 18 | 0.166401 | 20237 | 0 | 121616 |
| 28 | 19 | 0.217646 | 29375 | 0 | 134967 |
| 29 | 20 | 0.255365 | 39223 | 0 | 153596 |
| 30 | 21 | 0.275718 | 43462 | 0 | 157632 |
| 31 | 22 | 0.293256 | 47803 | 735 | 163008 |