INNOVATIONINSIGHTS: A Visual Analytics Approach for Understanding the Dual Frontiers between Science and Technology

SCAN ME

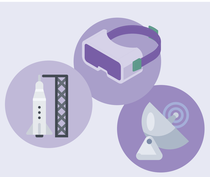
1 Introduction

Research Questions

Understanding and Decision-making

- How to understand the dual frontiers of science and technology?
- How to identify gaps and opportunities for innovation and facilitate more rapid and effective knowledge transfer?

Science



Technology

Goals

Data-driven Interactive Visual Exploration

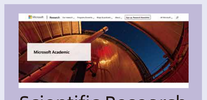
Researcher Identification
Who are potential inventors?

Interplay Exploration
How is science used by technology?

Invention Prediction
Where are innovation potentials?

Data Sources

Papers, Patents, and Researchers



Scientific Research

Technical Inventions

Reliance on Science

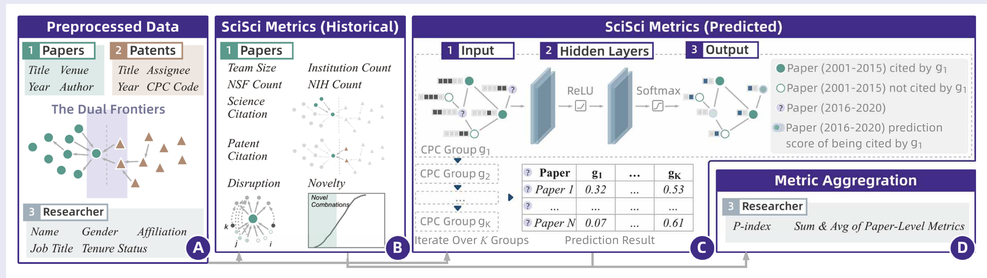
Researcher Profiles

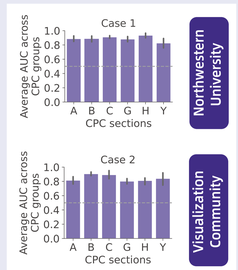
2 Methodology & Results

Data Analysis Module

Preprocessing, Scientific Facts and Invention Prediction

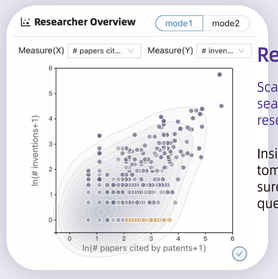
- The data analysis module calculates the contextual information that supports visual analysis and decision-making. In particular, two types of information are considerred: (1) the data facts about papers, patents, and researchers calculated based on SciSci metrics; (2) the potentials of a paper to be transferred, which is estimated by a deep learning prediction model implemented by a graph convolutional network (GCN).





Data Visualization Module

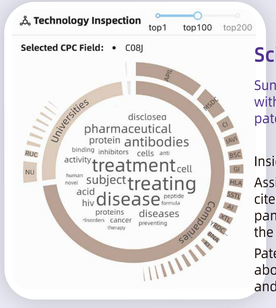
Visualization and Interaction Design



Researcher Overview

Scatterplot: overview of all researchers (within an institution or research field).

Insight: researchers in the bottom-right had no invention disclosures, yet their papers had been frequently cited by other patents.



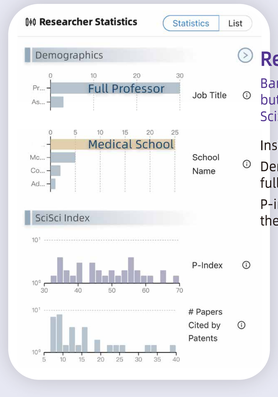
Science Inspection

Sunburst diagram: assignee types with coresponddding number of patents.

Insights

Assignee type: they were being cited heavily by patents from companies, finding widespread uses in the private sector.

Patent topic: most citing patents are about treatment, disease, protein, and cell.



Researcher Statistics

Barcharts and Histograms: distributions of demographics and SciSci metrices.

Insights

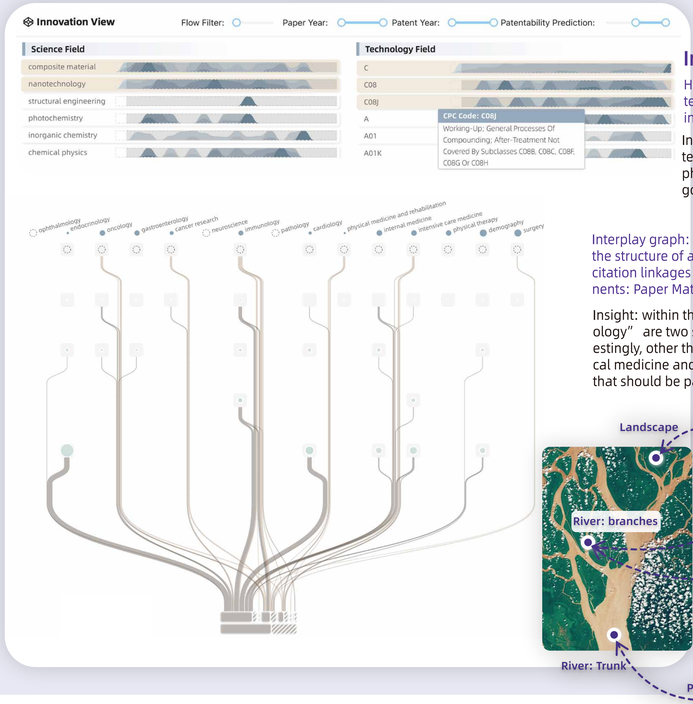
Demographics: most of them are full professors at medical school.

P-index: a considerable number of them are with high patentability.

Paper Inspection

Paper list: detailed meta information of papers.

Histogram: distributions of SciSci metrices



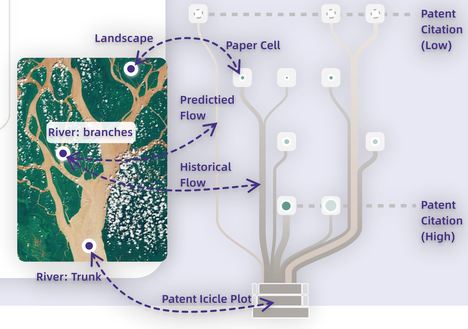
Innovation Analysis

Horizon graphs: compactly reveal the temporal evolution of different fields in science and technology.

Insights: paper field "composite material" is falling while "chemical physics" are rising. Patent CPC category C isa recently emerging field.

Interplay graph: the design is inspired by the river metaphor: (A) the structure of a river; (B) the river-like visual metaphor shows citation linkages between papers and patents with three components: Paper Matrix, Patent Icicle Plot, and Citation Flow.

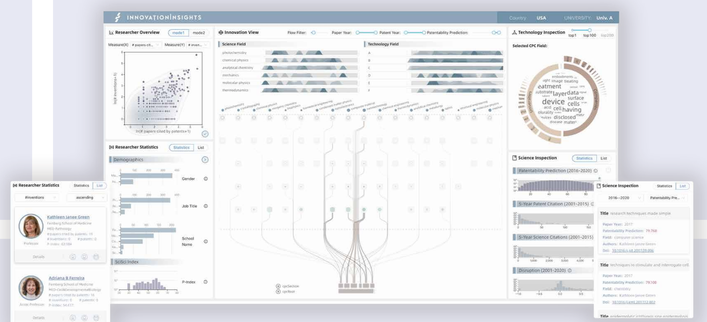
Insight: within the medicine field, "Endocrinology" and "cardiology" are two science fields be cited heavily by patents. Interestingly, other three fields - "intensive care medicine", "physical medicine and rehabilitation", and "surgery" are new topics that should be paid more attention to.



3 Conclusion

Conclusion

- Conducted analysis on SciSci metrices and built a prediction model to indicate potentials of technology trasferring of papers.
- Proposed a novel design, InterplayGraph, to visualize the complex interactions between science and technology.
- Built InnovationInsights, a first-of-its-kind visual analysis system for researchers and research institutions to explore the dual frontiers of science and technology.

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