

Forecasting technology emergence: Scenario exploration and prediction accuracy

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Research Background

Technology forecasting is no easy task.

- Rapid technology advancement

Technology forecasting is increasingly important.

- Scarce resources
- Escalating global competitions

Yet, among the fast growing number of studies on technology forecasting approaches, **evaluating prediction accuracy remain under-investigated due to the lack of golden criteria and the absence of comparison indicator**, shadowing the true value of technology forecasting on wise decision making in R&D portfolio investment and innovation management.

Research Purpose

- To experiment different approaches of technology forecasting;
- To develop **quantitative measures** to compare their prediction performance;
- To examine prediction performance in **both science space and technology/innovation space**

Data & Methodology

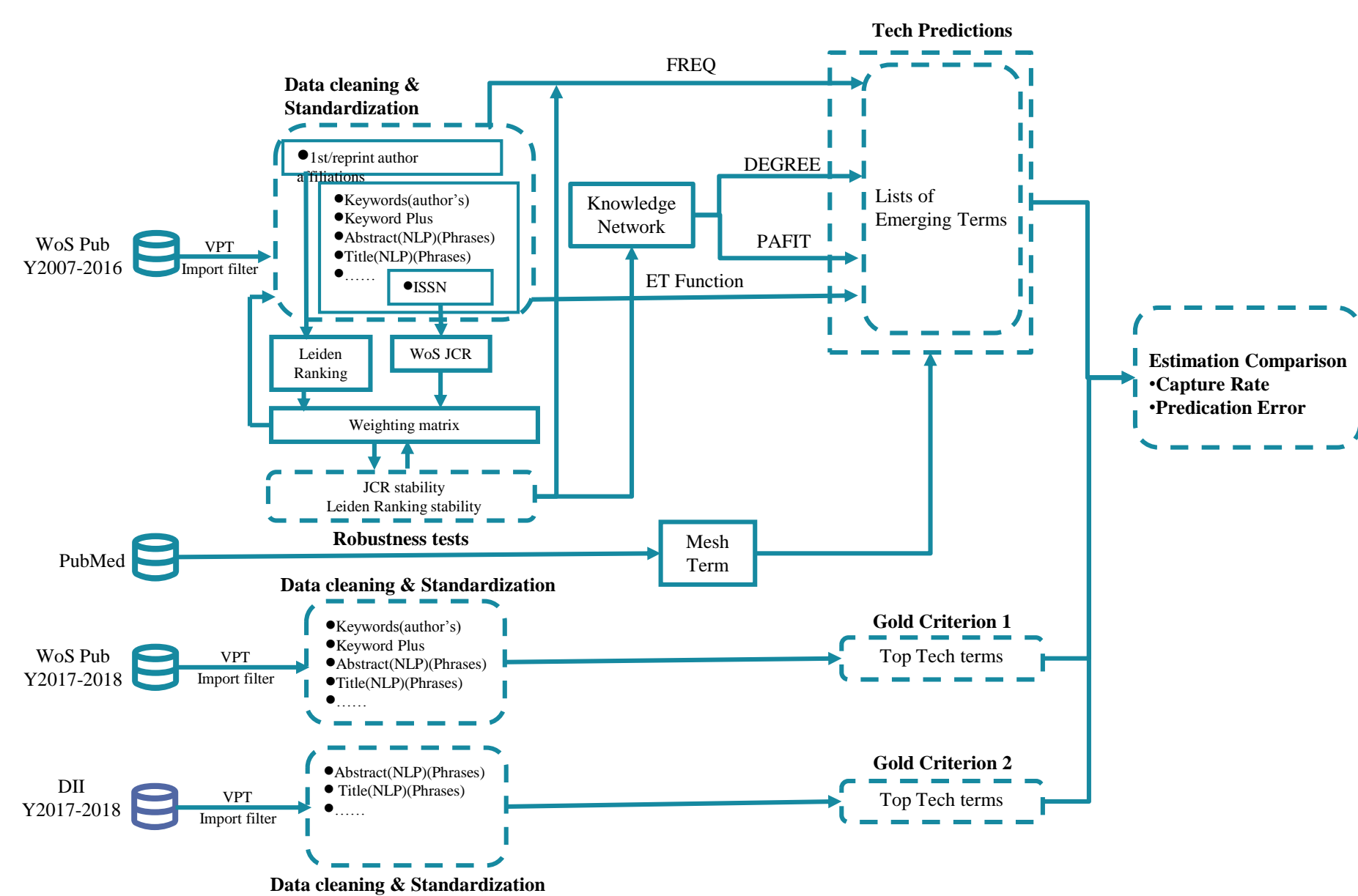


Fig 1. Flowchart of Technology Forecasting

Data sources

Trial dataset: Web of Science publications (Y2007-Y2016), n1= 67,077

Golden criteria datasets:

- Web of Science publications (Y2017-Y2018), N1= 18,335
- Derwent Innovation Index patents (Y2017-Y2018), N2= 317

Complementary datasets:

- JCR; Leiden Ranking; PubMed

Focus area: Synthetic biology

Prediction methods

FREQ: frequencies of technical key words

DEGREE: network indicator based on key words co-occurrence

PAFIT: bayesian statistical indicator

ES: emergence score algorithm

Prediction performance measurements

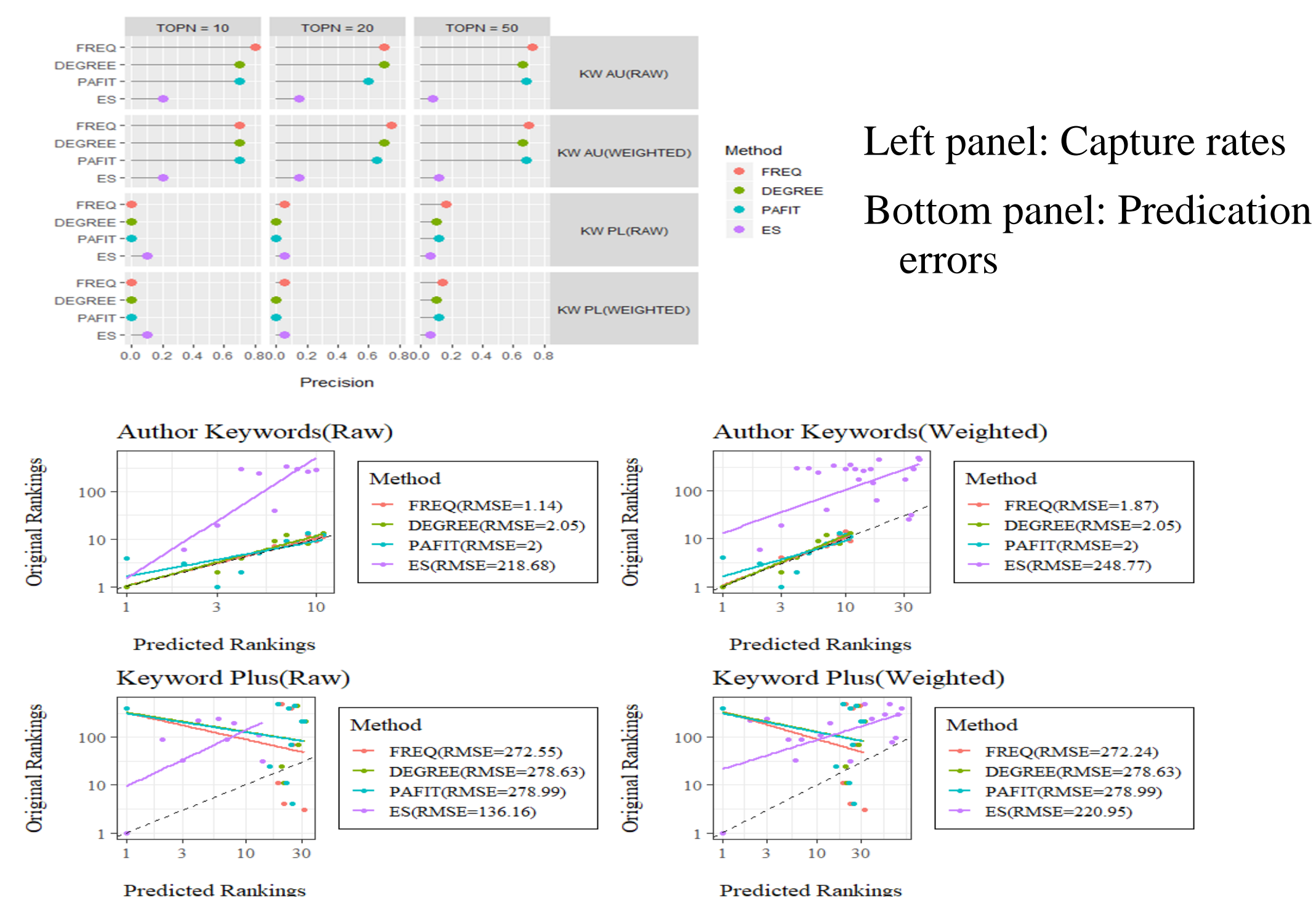
1. prediction precision

$$\text{Capture Rate} = (\# \text{correctly predicted hotspots} / \# \text{actual hotspots}) * 100\%$$

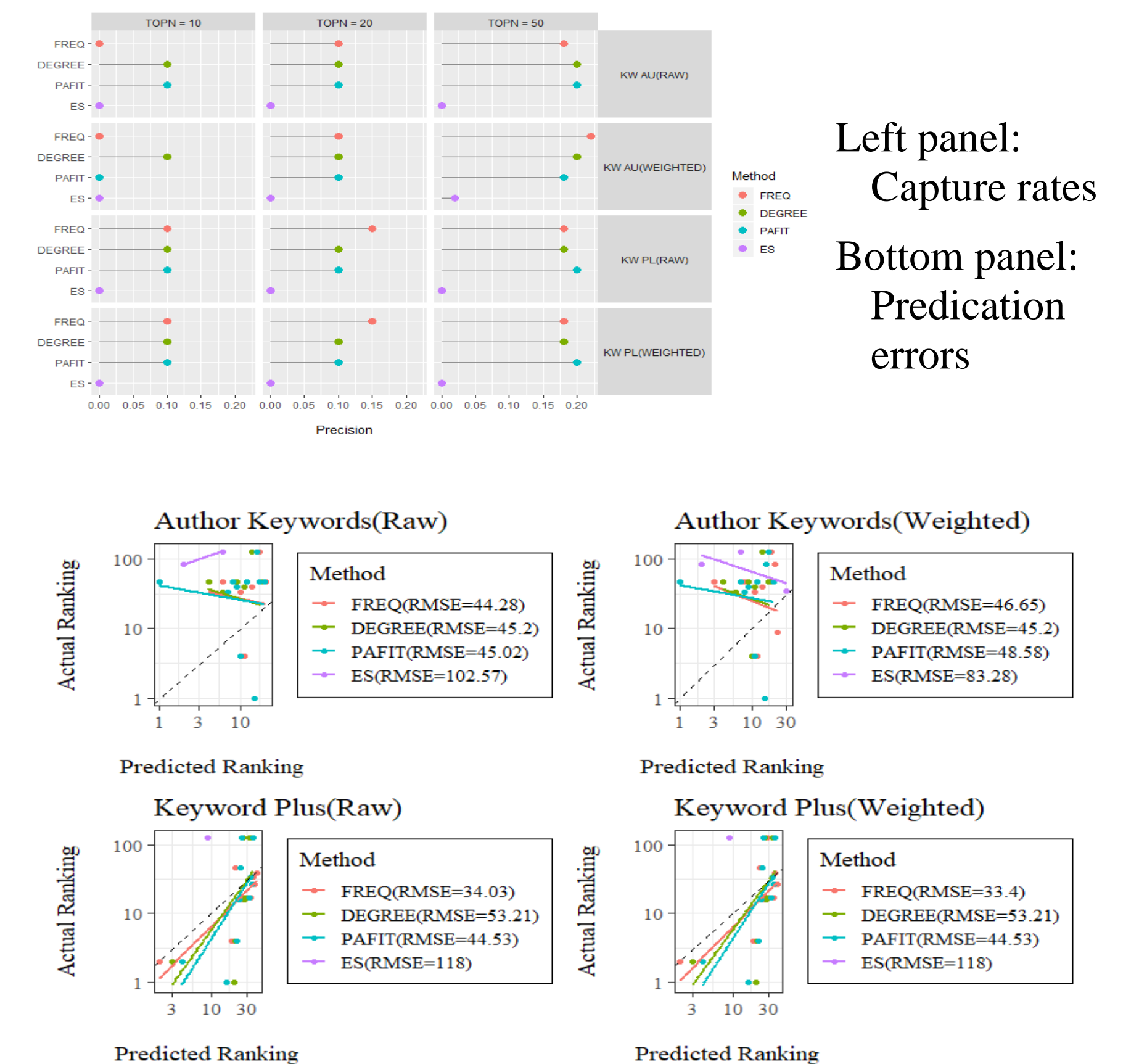
2. prediction error: $\text{RMSE} = \sqrt{\sum di^2 / n}$

Finding illustrations

Science advancement forecasting



Technological innovation forecasting



Preliminary Findings

- Keywords (Authors) itself seems work pretty good in projecting **scientific evolution** in field of synthetic biology . The weightings are not working well as we expect (marginal improvement).
- Yet, none of the four approaches perform well in predicting **technological innovation**.

Discussion

Limitations & future research directions

- Arbitrary/subjective selection (of research field; forecasting years; criteria dataset)

Policy implications

- **(Only)** correct technology forecasting can assist government decision makers and corporation managers to make wise decisions on R&D investment portfolio.