

# Node-Level Analysis from Graph Theory to Identify Influential Authors

## Measuring the Impact of Law Research in SA Courts



### INTRODUCTION

There are many ways of measuring the impact of academic research in other academic research. Academic research impact measurements include citation count measures like the h-index. The Faculty of Law at the University of Pretoria, however, wants to understand the impact of law research in the courts of South Africa.

### PURPOSE OF RESEARCH

The purpose of the research is to define and explore measures of impact of law research in South African courts through graph theory and subsequent node-level analysis of the network to identify influential authors. The goals of the research are listed as follows:

- i. Compare and document different metrics for research impact
- ii. Identify seminal research that has had lasting impact

### METHODOLOGY

The first step was to transform the three volumes of *Fontes Juris* - a published book that contains source references of the law noted in South African Superior Court Cases since 1828 – into structured data using text mining and a decision tree algorithm to enable graph network modelling.

The next step involved the modelling of the network. A two-mode network (author and judgement pairs) was created to allow for centrality measures to be calculated. The two-mode network resulted in a very sparse (low density) model. The two-mode network was subsequently transformed into a one-mode network resulting in an author-node only network with 60 times higher density.

The final igraph object was produced following these steps:

- i. Incidence matrix from the two-mode igraph network object using `as_incidence_matrix()` function from `igraph` library
- ii. Calculate intersection distance of the incidence matrix to calculate edge weights
- iii. Set diagonals of matrix to zero

### EXPERIMENTS

A node-level analysis was executed by calculating the following centrality measures for the one-mode (author-only nodes) network:

- o Degree Centrality
- o Eigenvector Centrality
- o Closeness Centrality
- o Betweenness Centrality
- o PageRank Centrality

The centrality measures were compared with traditional bibliometric indices (including h-index, m-quotient and g-index) for the same collection of data.

### RESULTS

The centrality measures was able to identify the authors **VOET**, **GROTIUS** and **HALSBURY** as influential authors in South African courts. Figure 1 shows the judgment citation count of a span of 165 year for the most influential author, **VOET**.

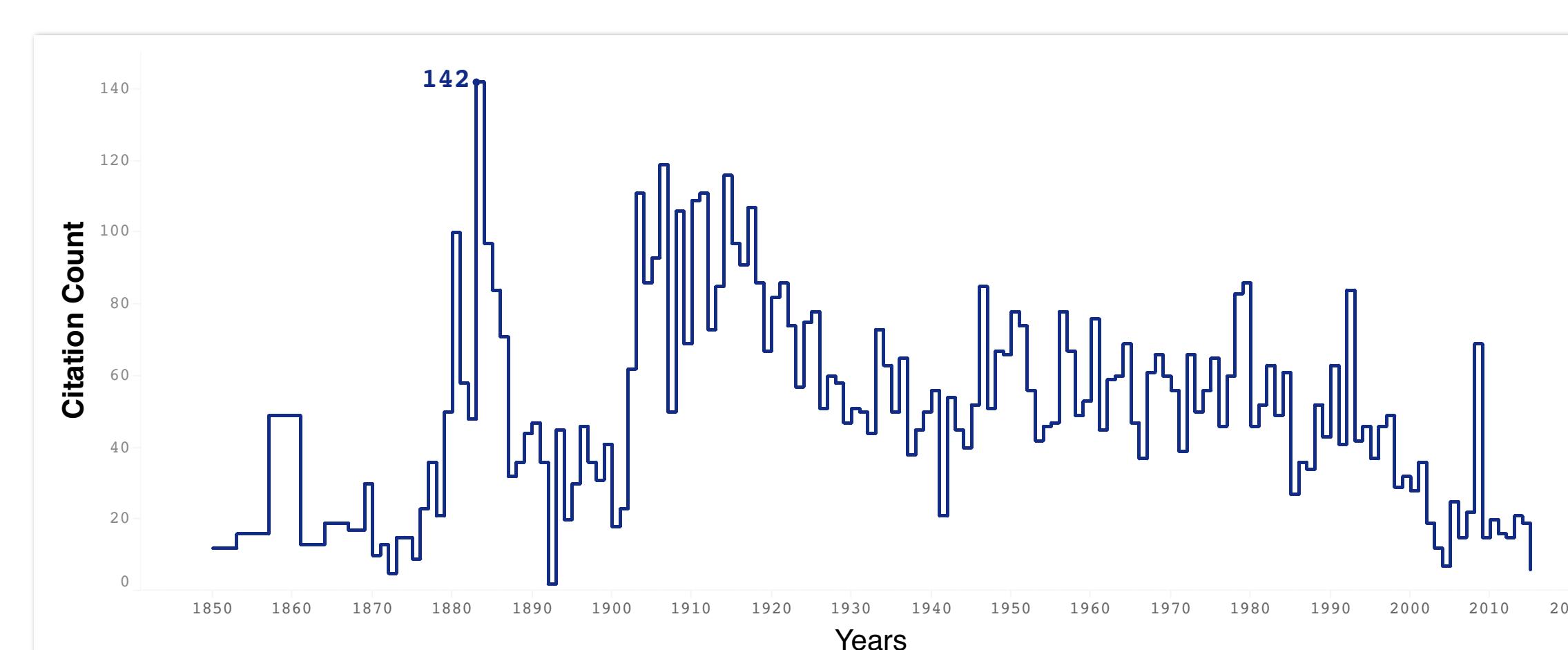
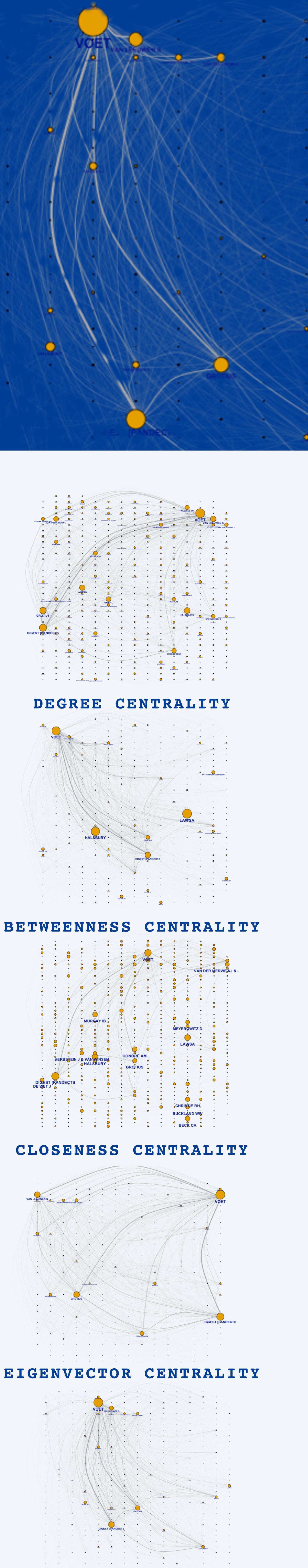


Figure 1 : Citation Count of Years for VOET (author)



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