

# Adaptive Analytics: Detecting Diagnostic Bias Via Social Network Analysis

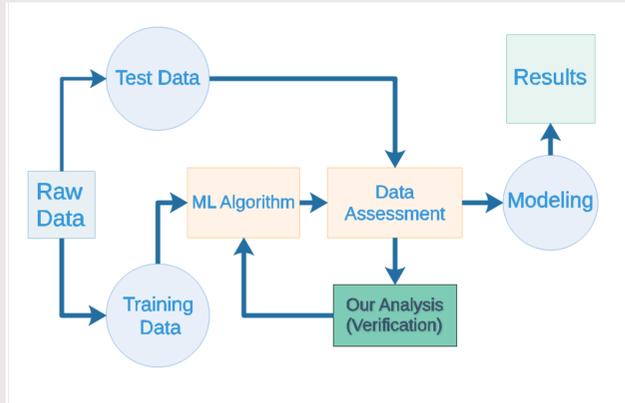
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DataLab12.github.io

## Introduction

We present a patent-pending algorithm to characterize and detect bias in social and content networks at scale.

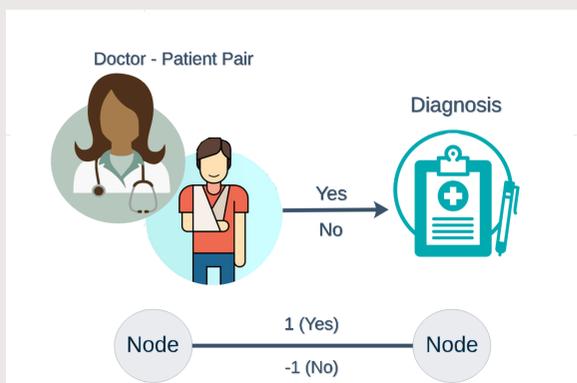


We identify standard practice of operating procedures.

### System Features

- Flagged anomalous behavior with respect to group norms.
- **Ethical verification layer** for ML/AI agent in the network.
- **Consensus-driven decision** benchmark in the network.
- **Ranks** individuals at scale for large social and content networks.
- **Anonymity** preserving analysis and feedback at scale.

## Diagnostics Network

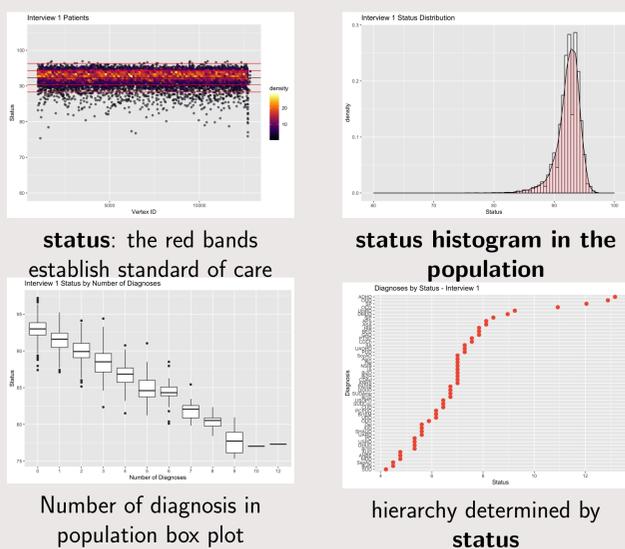


Diagnostics Network connects doctors with patients through diagnoses and symptoms.

Patent-pending network analysis produces a **measure** of doctor efficacy, and **diagnostic hierarchy** to the doctor based on the network of colleagues and their decisions. We introduce **status** as measure of the "standing" in the network. The system empowers patient portals to seek the most effective treatment plans.

## Clinical Data Analysis

Diagnostics Network Analysis: patient status measure



status: the red bands establish standard of care

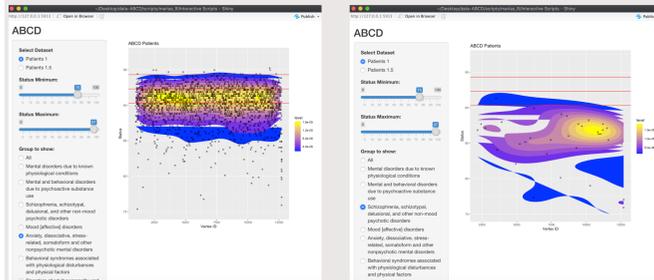
hierarchy determined by status

We analyzed an anonymous health dataset of  $\approx 12,000$  doctor/patient pairs and  $\approx 55$  diagnoses. This method establishes a **standard of care** and **diagnostic hierarchy** from Diagnostics Network with one thousand simulated consensus scenarios.

## Interactive Diagnostics

Interactive interface enables end-user to:

- explore trends by diagnostic category
- review and provide feedback on flagged anomalous cases using expert knowledge

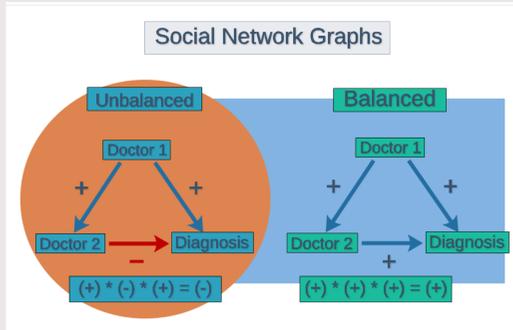


Non-psychotic subset of disordered status against standard of care

Non-mood psychotic subset of disordered status against standard of care

We present the analysis of status of two subsets of disorders, non-psychotic ((anxiety, stress-related, and somatoform) and psychotic (schizophrenia, schizotypal, delusional). The subsets are analyzed against established standard of care in the diagnostics network.

## Consensus

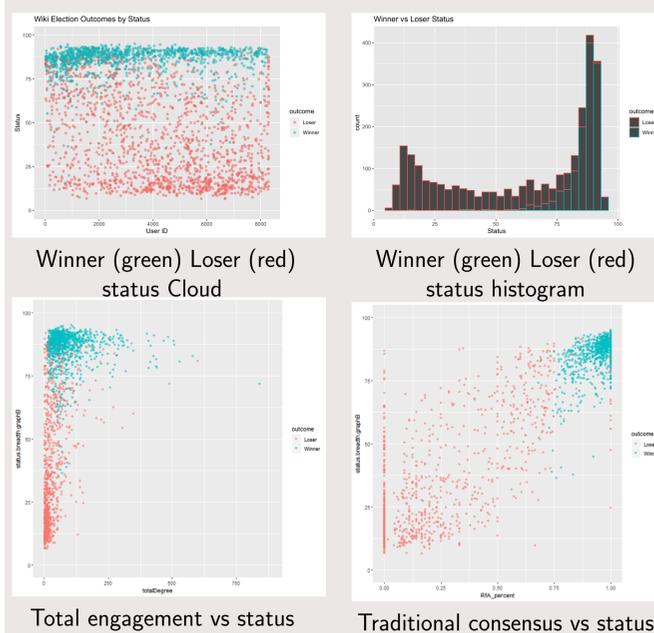


Example of balancing network for consensus

Consensus measures the level of agreement in the network. Psychological concept of balance theory is used to model consensus scenarios so that consensus is reached when the overall sentiment of the network is balanced. The likelihood of consensus is called **status**.

## Social Network Analysis

Social network constructed from Wikipedia dataset of over 7000 users participating in administrator election, with the known outcomes of the elections (elected or not elected).

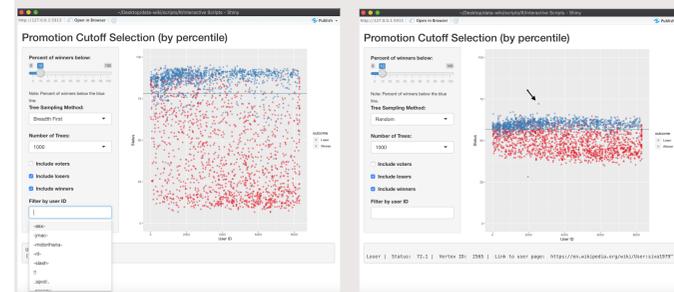


Total engagement vs status

Traditional consensus vs status

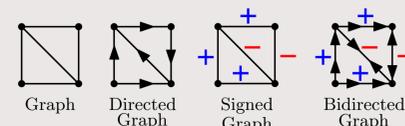
Graph **status** shows strong correlation with election outcome. Outcome anomalies are defined relative to the promotional outcomes to identify **questionable** and **lacking** promotions.

## Interactive Promotion

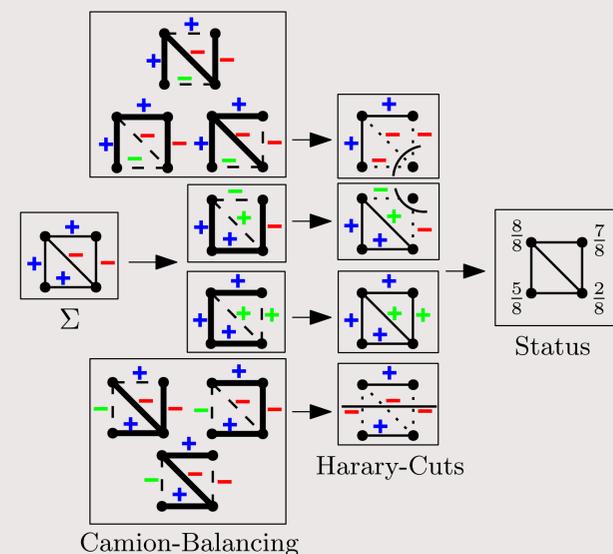


Breath-first search consensus modeling technique  
Random consensus modeling technique  
Social network constructed from Wikipedia dataset of over 7000 users participating in administrator election. The outcomes of promotion in Wiki network are known.

## Scientific Method



A **signed graph** is a graph where each edge has a sign. A **directed graph** is a graph where each edge has a direction.



Example of graph balancing using balancing theory. Harary cuts are used to compute **status** measure from multiple balanced graphs.

**Status** is the number of times a node falls in the agreeable majority out of all simulations. The more times a node is in the agreeable majority, the more likely they will contribute to overall consensus in the network.

The proposed method is **patent-pending**, and it has been applied to various health, social, and HR data with promising initial results.

## People

Faculty:

Jelena Tešić, Assistant Professor, Computer Science  
Lucas Rusnack, Assistant Professor, Mathematics

Students:

Maria Tomasso, Ph.D. student, and Joshua Mitchell, M.Sc student.  
Eric Hull, and Benjamin Bond, undergraduate students.



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