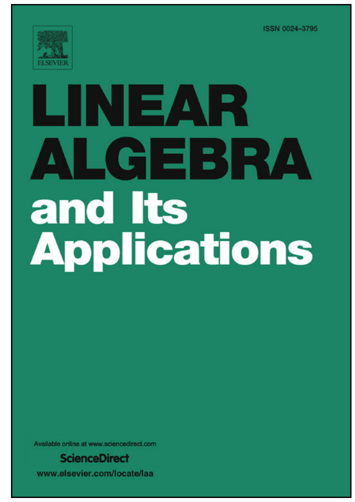
Accepted Manuscript



Recovering the structure of random linear graphs

Israel Rocha, Jeannette Janssen, Nauzer Kalyaniwalla

PII: S0024-3795(18)30357-4
DOI: https://doi.org/10.1016/j.laa.2018.07.029
Reference: LAA 14671

To appear in: *Linear Algebra and its Applications*

Received date: 9 May 2017
Accepted date: 21 July 2018

Please cite this article in press as: I. Rocha et al., Recovering the structure of random linear graphs, *Linear Algebra Appl.* (2018), https://doi.org/10.1016/j.laa.2018.07.029

Recovering the Structure of Random Linear Graphs

Israel Rocha[a,*], Jeannette Janssen[b], Nauzer Kalyaniwalla[c]

[a]*The Czech Academy of Sciences, Institute of Computer Science, Pod Vodárenskou věží 2, 182 07 Prague, Czech Republic.*
[b]*Department of Mathematics and Statistics. Dalhousie University, Halifax, Canada.*
[c]*Faculty of Computer Science. Dalhousie University, Halifax, Canada.*

Abstract

In a random linear graph, vertices are points on a line, and pairs of vertices are connected, independently, with a link probability that decreases with distance. We study the problem of reconstructing the linear embedding from the graph, by recovering the natural order in which the vertices are placed. We propose an approach based on the spectrum of the graph, using recent results on random matrices. We demonstrate our method on a particular type of random linear graph. We recover the order and give tight bounds on the number of misplaced vertices, and on the amount of drift from their natural positions.

Keywords: Random graphs; Toeplitz Matrices; Random Matrices; Seriation problem; Stochastic Block Model; Rank correlation coefficient
2000 *Mathematics Subject Classification*: 05C50; 05C85; 15A52; 15A18

1. Introduction

Spatial networks are graphs with vertices located in a space equipped with a certain metric. In a random spatial network two vertices are connected if their distance is in a given range. Random spatial networks have been used in the study of DNA reconstruction, very large scale integration (VLSI) problems, modelling wireless *ad hoc* networks, matrix bandwidth minimization, etc. The book [21] contains a rich source for the mathematics behind these structures.

One particular instance of these graph models are the so called one-dimensional geometric graphs, where the vertices are points in $\mathbb{R}$, connected with some proba-

*israelrocha@gmail.com
Email addresses: `israelrocha@gmail.com` (Israel Rocha), `jeannette.janssen@dal.ca` (Jeannette Janssen), `nauzerk@cs.dal.ca` (Nauzer Kalyaniwalla)