BAYESIAN MODELING OF PLANT DROUGHT RESISTANCE PATHWAY

A Thesis

by

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MASTER OF SCIENCE

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Abstract

Plants are sessile organisms and are unable to relocate to favorable locations under extreme environmental conditions; and hence they have no choice but to acclimate and eventually adapt to the severe conditions to ensure their survival. With climate change affecting the environment adversely, it is of utmost importance to make plants and crops robust enough to withstand harsh conditions and safeguard global food production. As traditional methods of bolstering plant defense against stressful conditions come to their biological limit, we require newer methods that can allow us to strengthen the plant’s internal defense mechanism. This motivated us to look into the genetic networks of plants. In this thesis, we lay out a method to analyze genetic networks in plants that are activated under abiotic stress, specifically drought conditions. This method is based on the analysis of Bayesian networks and should ultimately help in finding genes in the genetic networks of the plant that play a key role in its defense response against drought.

The WRKY transcription factor is well known for its role in plant defense against biotic stresses, but recent studies have shed light into its activity against abiotic stresses such as drought. Therefore, it is logical to study the various components of the WRKY gene network in order to maximize a plant’s defense mechanism. We use Bayesian networks to model the WRKY gene network and then use synthetic data to estimate the network parameters. The estimated parameters are used to build a Bayesian decision network, where nodes are selected one at a time for intervention and the utility for the upregulation of downstream abiotic stress response is computed. The node that maximizes this utility is recommended for biological intervention.

Dedication

The Dedication page is optional and follows the Abstract. The word DEDICATION is optional as a heading at the top of the page. If the preliminary pages are listed in the Table of Contents, include the Dedication. The heading is bold if other major headings in the thesis / dissertation are bold. The text in the Dedication is limited to one page and is in the same font size and style as the other text in the thesis/dissertation.

Acknowledgements

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(*Sample Wording*)

I would like to thank my committee chair, Dr. Smith, and my committee members, Dr. Jones, Dr. Morton, Dr. Anderson, and Prof. Benner, for their guidance and support throughout the course of this research.

Thanks also go to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience.

Finally, thanks to my mother and father for their encouragement and to my wife for her patience and love.

contributors and funding sources

All theses and dissertations must include a contributors and funding sources section. In this section, name all members of the dissertation committee, and any collaboration with others in carrying out your thesis or dissertation research. Your independent contributions must be made clear.

If financial support from the university, or any other source was gained to conduct your thesis or dissertation research and compilation, it must be listed in this section. If you completed all work independently without outside financial support, indicate this here.

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This work was supported by a dissertation committee consisting of Professor XXX [advisor – also note if co-advisor] and XXXX of the Department of [Home Department] and Professor(s) XXXX of the Department of [Outside Department].

The data analyzed for Chapter III was provided by Professor XXXX. The analyses depicted in Chapter IV were conducted in part by Rebecca Jones of the Department of Biostatistics and were published in (year) in an article listed in the Biographical Sketch.

All other work conducted for the dissertation was completed by the student independently.

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This work was supervised by a dissertation committee consisting of Professor XXXX [advisor – also note if co-advisor] and Professor(s) XXXX of the Department of [Home Department] and Professor(s) XXXX of [Outside Department]. All work for the dissertation was completed independently by the student.

*(or)*

Graduate study was supported by a fellowship from Texas A&M University and a dissertation research fellowship from XXX Foundation.

Nomenclature

DAG Directed Acyclic Graph

PGM Probabilit

P Pressure

T Time

TVA Tennessee Valley Authority

TxDOT Texas Department of Transportation

This optional list may be placed in the following places: before the Table of Contents, as the last preliminary page, before the Reference section, or as an Appendix. The heading is bold if other major headings are bold, and the list is in the same font size and style as text.

Table of Contents

Page

List of Figures

Page

List of Tables

Page

1. Introduction

Standard margins on this page, and on all text pages, are 1.4” left, 1.15” right, 1.25” top and bottom. Margins must be a minimum of 1” on all sides and consistent throughout the document. If binding, a margin of 1.4” is recommended. The page number (Arabic) 1 is in the bottom center of the page. Number every page of the thesis in sequence through to the end of the document (references or appendix).

If the thesis is written using the *section method*, the major heading will consist of a title, centered and in all capital letters. This heading may be numbered (Arabic or Roman) or unnumbered. If you are numbering your subheadings by section (1.1, 1.2, etc.), you must number your major headings. Do not use the word “chapter” in your text since your work is not organized in chapters. No punctuation occurs at the end of section titles.

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**The previous page had an example of the chapter method. Please choose either style, and delete the other option.**

2. Biological background

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3. bayesian network model

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4. parameter estimation

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5. BAYESIAN DECISION NETWORKS

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5. MAXIMUM EXPECTED UTILITY

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5. DATA GENERATION And SIMULation

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6.RESULTS

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7.Conclusion

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References

Reference sections may occur in one of two locations: at the end of the main text or at the ends of each chapter. If the references appear at the end of each chapter, they should be located under a subheading, such as “References” or “Bibliography.”