

## Table of Contents

<b>Acknowledgments .....</b>	<b>iv</b>
<b>Abstract .....</b>	<b>vi</b>
<b>Table of Contents .....</b>	<b>viii</b>
<b>List of Tables .....</b>	<b>xii</b>
<b>List of Figures .....</b>	<b>xiii</b>
<b>List of Abbreviations .....</b>	<b>xv</b>
<b>1 Introduction .....</b>	<b>1</b>
1.1 Background: Auditory System .....	4
1.1.1 Ear: Anatomy and Physiology .....	5
1.1.2 Properties (Physiology) of auditory-nerve fibers .....	8
1.1.3 Auditory-nerve fiber representation for speech-like stimulus.....	13
1.1.4 Motivation behind developing signal processing based computational models .....	15
1.2 General approach used in this dissertation .....	19
1.3 Research Objectives .....	20
1.4 Overview of this dissertation work .....	20
<b>2 Modeling the level-dependent changes of concurrent vowel scores</b>	<b>23</b>
2.1 Introduction.....	23
2.2 Methods.....	26

2.2.1	Stimuli .....	26
2.2.2	Computational Modeling: Predicting identification scores across sound level and F0-difference conditions.....	28
2.3	Results.....	33
2.4	Discussion .....	43
2.4.1	Sensitivity of predicted concurrent-vowel identification scores to AN-model parameters .....	43
2.4.2	Effect of $m_1/m_2$ on identification of identical vs. different vowels.	44
2.4.3	Selection of single-vowel templates for identification .....	44
2.4.4	Possible physiological mechanisms underlying the level-dependent changes in identification scores of concurrent vowels.....	45
2.4.5	Conclusion .....	45
<b>3</b>	<b>Modeling concurrent vowel identification for shorter durations.....</b>	<b>47</b>
3.1	Introduction.....	47
3.2	Methods.....	49
3.2.1	Stimuli .....	49
3.2.2	Computational auditory-nerve model .....	50
3.2.3	F0 guided segregation algorithm.....	50
3.3	Results.....	50
3.4	Discussion .....	56
3.5	Conclusion.....	59

<b>4 Modeling the effects of age and hearing loss on concurrent vowel scores</b>	<b>60</b>
4.1 Introduction	60
4.2 Methods	67
4.2.1 Stimuli	67
4.2.2 General Modeling Framework	67
4.2.3 YNH model	70
4.2.4 ONH model	71
4.2.5 OHI model	71
4.3 Results	72
4.4 Discussion	83
4.4.1 Effect of F0 difference cue on concurrent vowel scores across three listening models	83
4.4.2 Effect of CS on predicting concurrent-vowel scores for the ONH and OHI models	84
4.4.3 Sensitivity of predicted concurrent-vowel scores to model parameters	85
4.4.4 Possible physiological mechanisms underlying reduced concurrent vowel scores due to increased age and hearing loss	87
4.4.5 Conclusion	87
<b>5 Discussion and Future Work</b>	<b>89</b>
5.1 Problem statement	89

5.2	Significance of the dissertation work .....	89
5.3	Limitation of the model .....	92
5.4	Future Work.....	93
5.4.1	Motivated Behavioral studies .....	93
5.4.2	Auditory Nerve Models.....	93
5.4.3	Clinical Applications .....	94
<b>References</b>	.....	<b>95</b>
<b>List of publications and presentations</b>	.....	<b>107</b>
<b>Brief Biography of the Candidate</b>	.....	<b>108</b>
<b>Brief Biography of the Supervisor</b>	.....	<b>109</b>