

COMPUTATIONAL MICROBIOME ANALYSIS: METHODS AND
APPLICATIONS

(Spine title: Computational microbiome analysis: methods and applications)
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by

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Computational microbiome analysis: methods and applications

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Abstract

With the advent of next generation sequencing, scientists can obtain a more comprehensive snapshot of the bacterial composition of the microbiome, what genes they have, and what proteins they produce. We are in a phase of developing the experiments and accompanying statistical techniques to elucidate the exact mechanisms by which the human microbiome affects health and disease. In this thesis we explore alternatives to the standard weighted and unweighted UniFrac metric for measuring the difference between microbiome samples, to elucidate different trends and outliers. We also apply next generation sequencing and computational analysis techniques to gut microbiome data to examine relationship of the microbiota to atherosclerosis and non alcoholic fatty liver disease.

Keywords: Human microbiome, next generation sequencing, bioinformatics, atherosclerosis, non alcoholic fatty liver disease

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Chapter 1

Time series: Long memory

Here is a picture of a long memory time series.



Figure 1.1: A long memory time series

Here's a table.

n	α	$n\alpha$	β
1	0.2	0.2	5
2	0.3	0.6	4
3	0.7	2.1	3

Table 1.1: A random table

$$y = mx + b \quad (1.1)$$

$$= ax + c \quad (1.2)$$

This is an un-numbered equation, along with a numbered one.

$$\begin{aligned} u &= px \\ p &= P(X = x) \end{aligned} \quad (1.3)$$

Look at Table 1.1 and Figure 1.1 and equations 1.1, 1.2, and 1.3.

Let's do some matrix algebra now.

$$\det \left(\begin{pmatrix} 2 & 3 & 5 \\ 4 & 4 & 6 \\ 9 & 8 & 1 \end{pmatrix} \right) = 42 \quad (1.4)$$

In the equation and eqnarray environments, you don't need to have the dollar sign to enter math mode.

$$\alpha = \beta_1 \Gamma^{-1} \quad (1.5)$$

This is citing a reference [2]. This is citing another [3]. Nobody said something [1].

Chapter 2

Theorems

2.1 Basic Theorems

Theorem 2.1.1 $e^{i\pi} = -1$

Bibliography

[1] Nobody Jr. My article, 2006.

[2] ME. Oh, my! 1990.

[3] Mr. X. *Mr. X Knows BibTeX*. AWOL, 2005.

Appendix A

Proofs of Theorems

Proof of Theorem 2.1.1

$$e^{i\pi} = \cos(\pi) + i \sin(\pi) \tag{A.1}$$

$$= -1 \tag{A.2}$$

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Curriculum Vitae

Name: Ruth Wong

Post-Secondary Education and Degrees: The University of Western Ontario
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2010-2014 B.M.Sc.

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Wong, Ruth G., Jia R. Wu, Gregory B. Gloor. "Expanding the UniFrac toolbox." Full length paper accepted for oral presentation at the Great Lakes Bioinformatics and the Canadian Computational Biology Conference 2016.