



Self-learning of Neuroimaging Theory

—based on the book: *Adaptive Spatial Filters for Electromagnetic
Brain Imaging*

Author: Jie Li

Institute: University of Kent

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Bio: Ph.D. Candidate in Statistics

School of Mathematics, Statistics and Actuarial Science

University of
Kent

A journey of a thousand miles begins with a single step. — Lao Tzu

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Chapter 1 Introduction

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1.1 Functional brain mapping

What is functional brain mapping? According to [Wikipedia](#), *Brain mapping* is a set of neuroscience techniques predicated on the mapping of (biological) quantities or properties onto spatial representations of the (human or non-human) brain resulting in maps.

What can it be used to do?

- study the neural mechanisms underlying human behavior
- brain clinical diagnosis

Techniques for functional brain mapping

- positron emission tomography (PET, 正电子发射计算机断层显像)
- functional magnetic resonance imaging (fMRI, 功能磁共振成像)

The disadvantage : do not directly measure neuronal activities. Electrophysiological activity of neurons can generate both **electric potentials** as well as **magnetic fields**. At sub-millisecond time scale, the neurons' activities can be measured by

- magnetoencephalography (MEG, 脑磁图), 300 channels
- electroencephalography (EEG, 脑电图), 512 electrodes

MEG/EEG is very important because:

1. provide spatio-temporal brain activation profiles
2. algorithms that enable high-fidelity reconstruction of neuronal activities from MEG and EEG data.

Definition 1.1

