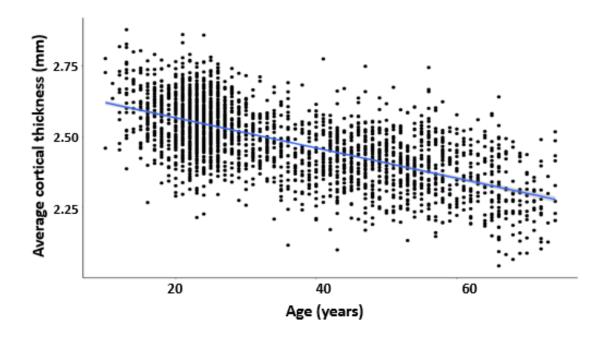
SITE EFFECT CORRECTION USING NORMATIVE MODELLING

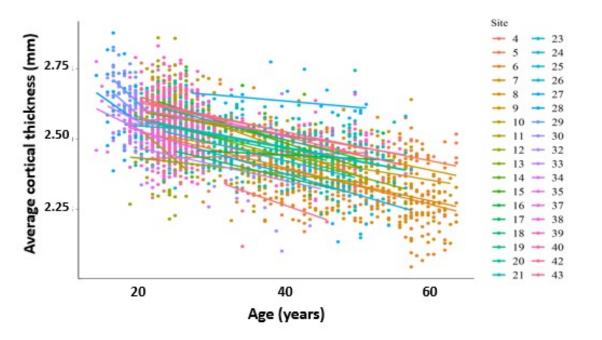
Normative modelling educational course
OHBM 2024, Seoul
Dr. Johanna Bayer



THE SITE EFFECT PROBLEM







ORIGINS OF SITE EFFECTS



'Sites' may differ in

Scanner platform

- Contrast-to-noise ratio
- Coil inhomogeneity

Sequence

- Sensitivity to tissue difference
- Sensitivity to motion

Acquisition

Procedure

- Task Details
- Instructions
- Circadianity
- Motion | Immobilisation

Image Postprocessing

Despite pipeline harmonization

Neurobiological (co-)factors

Severity of a condition of interest (e.g., a psychiatric disease)

Ag

Sex I Gender

Age-by-disease interaction

Neurological and medical comorbidity

Past psychiatric disease

Life events

Past and current medication

Background population

(e.g., ethnicity, genetic background)

Definition of healthy controls

Definition of clinical inclusion criteria

Other diagnostic instruments

Study protocol differences

Bayer et al. 2022



METHODS TO CORRECT FOR SITE EFFETCS





OPEN ACCESS

EDITED BY

Maxime Descoteaux, Université de Sherbrooke, Canada

REVIEWED BY

Paul Gerson Unschuld, Université de Genève, Switzerland Muhamed Barakovic, University of Basel, Switzerland

*CORRESPONDENCE

Johanna M. M. Bayer bayerj@student.unimelb.edu.au

[†]These authors share last authors!

SPECIALTY SECTION

This article was submitted to

Site effects how-to and when: An overview of retrospective techniques to accommodate site effects in multi-site neuroimaging analyses

Johanna M. M. Bayer^{1,2*}, Paul M. Thompson³, Christopher R. K. Ching³, Mengting Liu⁴, Andrew Chen^{5,6},

Review

Image harmonization: A review of statistical and deep learning methods for removing batch effects and evaluation metrics for effective harmonization



Fengling Hu^{a,*}, Andrew A. Chen^a, Hannah Horng^a, Vishnu Bashyam^b, Christos Davatzikos^b, Aaron Alexander-Bloch^{c,d,e}, Mingyao Li^f, Haochang Shou^{a,b}, Theodore D. Satterthwaite^{c,d,g}, Meichen Yu^{h,#}, Russell T. Shinohara^{a,b,#}



^a Penn Statistics in Imaging and Visualization Endeavor (PennSIVE), Department of Biostatistics, Epidemiology, and Informatics, Perelman School of Medicine, University

NORMATIVE MODELLING FOR SITE EFFECT CORRECTION



Accommodating site variation in neuroimaging data using normative and hierarchical Bayesian models

Johanna M M Bayer ¹, Ric^{*} Thomas Wolfers ⁴, Jinglei

Affiliations + expand

PMID: 36272672 PMCID:



Estimating cortical thickness trajectories in children across different scanners using transfer learning from normative models

C. Gaiser, P. Berthet, S. M. Kia, M. A. Frens, C. F. Beckmann, R. L. Muetzel, Andre F. Marquand

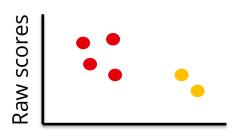
First published: 05 February 2024 | https://doi.org/10.1002/hbm.26565



USE CASES FOR NORMATIVE MODELLING FOR SITE EFFECT CORRECTION

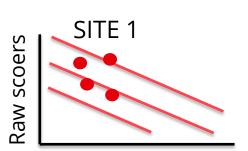


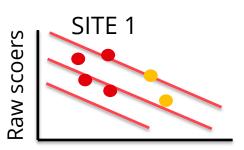
 1. Site effect correction: Making predictions for a site that is already in the training set.

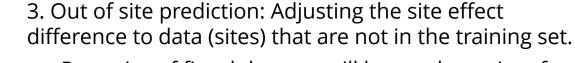


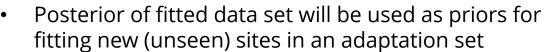


• 2. "Translating" between z-scores and raw scores, between sites.

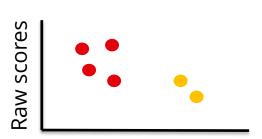








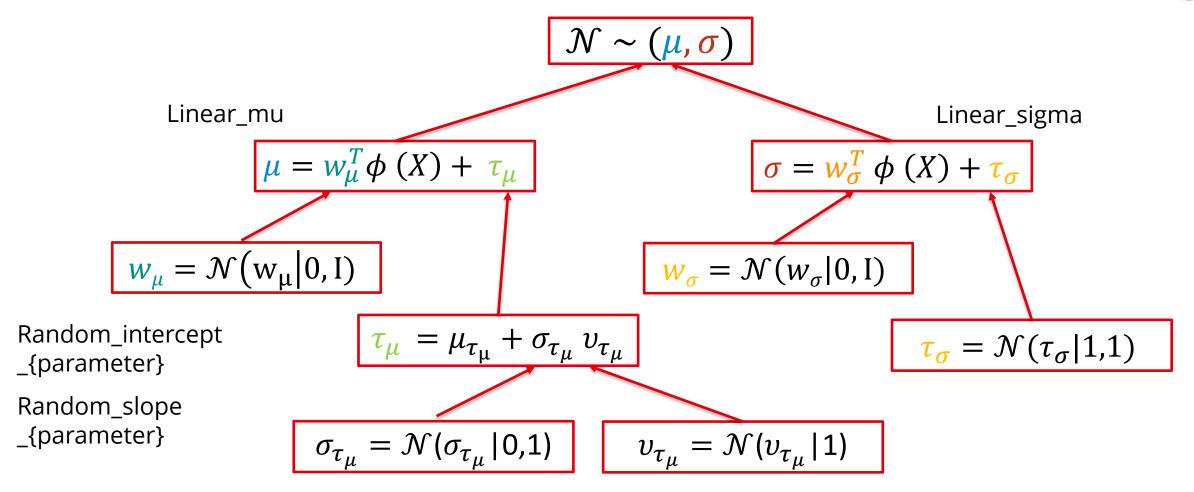






HIERARCHICAL BAYESIAN REGRESSION MODEL





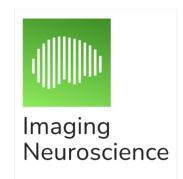
Spoiler: linear_delta and linear_epsilon for skewness and kurtosis also possible



HBR PAPER:



Volume 2 2024



April 25 2024

Non-Gaussian normative modelling with hierarchical Bayesian regression 3

Augustijn A. A. de Boer, Johanna M. M. Bayer, Seyed Mostafa Kia, Saige Rutherford, Mariam Zabihi, Charlotte Fraza, Pieter Barkema, Lars T. Westlye, Ole A. Andreassen, Max Hinne, Christian F. Beckmann, Andre Marquand ☑



Imaging Neuroscience (2024) 2: 1-36.

