HEALTHY AGING SIGNALS

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General Background - The Topic of Aging

- The topic of aging has almost always been associated with health issues.
- A large portion of age-related research has been focused on neurodegenerative disease, like cognitive decline, depression and Parkinson's disease.
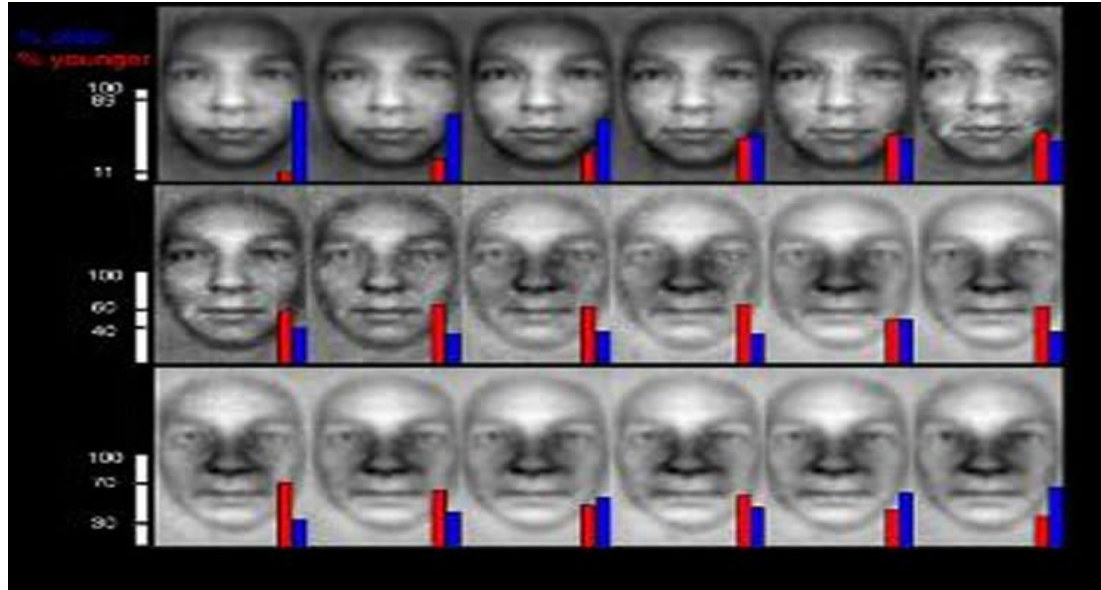
The Top 10 Hot Topics in Aging FREE

John E. Morley

The Journals of Gerontology: Series A, Volume 59, Issue 1, January 2004, Pages M24–M33,
https://doi.org/10.1093/gerona/59.1.M24
Published: 01 January 2004

Background - Aging signals

- Far less work has been done to understand the signatures and characteristics of aging itself.
- In our project, we are going to study the signals of aging, specifically healthy aging, potentially through lab imaging data, personal traits and DNA sequences.

Literature review timeline

2015 - Putin et al - Application of deep neural networks to biomarker development

- 21 DNN to predict human chronological age from blood tests

2018 - Tozer et al - Textured analysis of T1-weighted and fluid-attenuated inversion recovery images detects abnormalities that correlate with cognitive decline in small vessel disease

- Investigated correlation between texture parameters (TP) on MRI scans in relation to small vessel disease (SVD)
- Study showed differences in TP between SVD cases and controls

2020 - Lagner et al - Identifying Morphological Indicators of Aging with NN on large-scale whole body MRI

- Investigation into age-related changes in whole body MRIs of 32,000 subjects
- Trained a convolutional NN based on VGG16 architecture to predict the age of a given subject based image data from the scans

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Goals

- What are general signals of aging?

- How are these signals manifested in lab imaging data?

- How do we separate healthy aging signals from unhealthy ones?

- Two parts:

    - Process data

    - Model

Goals

- Processing data
    - Very large datasets
    - Representative 2D or 2.5D slices
- Model
    - Find aging indicators
    - Predict age/health state

Datasets

The Human Connectome HCP-Aging Database

689 Healthy individuals age 36 to 100

- Unprocessed brain imaging MRI data

- Minimally preprocessed structural MRI data for 128 subjects

- Basic demographic data (age, sex, race/ethnicity, handedness).

Datasets

PMI Parkinson's Database

215 in control group
All have had clinical assessments every 3 months for the past 9 years

Data

- Imaging, Structural MRI Imaging
- Gene expression, RNAseq
- Medical histories and demographic data
- Neurological exams
- Cognitive assessment tests