So You Want to Embrace Open Science in Research? How to Do This Responsibly

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Background/Problem Being Solved

Open science aims to develop multidimensional, generalizable knowledge that is findable, accessible, interoperable & reusable within the scientific community.
The neuroimaging community would benefit from high-quality, well-characterized, open-source databases, & publicly available tools for generating & analyzing curated data. Openness & connectivity on the design, performance, capture & assessment of research can create capacity for improvement & advocate for responsible & sustainable research and innovation.

Intervention(s)

In the past decade, there has been an exponential increase in published neuroscience literature accompanied by raw data, encouraging the creation of fee-free data-sharing initiatives to be used for research like cell morphometry analysis, magnetic resonance (MR) image analysis, & genomic, proteomic & transcriptomic analysis. Availability of open datasets benefits the medical community, statisticians, data scientists & early career researchers with access to data without requiring access to an imaging center. Several platforms host & support a variety of deposited data.

Barriers/Challenges

Creation of open data comes with challenges in privacy & standardization. Modern search engines are adept at combing through public files at scale to uncover a variety of data previously thought to be absent.

Outcome

The ACR recommends that image data needs to be processed in a way that does not allow reconstruction of potentially recognizable faces, while also balancing against preserving the utility of images.
Skull stripping removes everything outside the cranial cavity while defacing removes or replaces facial structures only. In case of head & neck cancers involving the face, if the estimated re-identification risk exceeds acceptable thresholds, images cannot be released publicly without restrictions. It is uncertain how AI-based techniques might be repurposed for modification of facial anatomy instead of complete removal. It is proposed to "mask" the face by interposing barriers in 3D space between the face & observer. The mask would have to contact the skin surface & have the same pixel-value distribution as the data. This discourages casual re-identification attempts & preserves greater utility than traditional de-facing approaches.

Scientific Research & Applied Informatics Posters and Demonstrations

Conclusion/Statement of Impact/Lessons Learned

AI can scrutinize medical images in ways that humans cannot. Models have predicted patient race from skeletal anatomy. Researchers are unable to isolate image features responsible for recognition or mitigate this ability by various efforts. While further research into this domain is needed, human-led efforts to detect racial biases & train models to equalize racial outcomes should be considered for medical safety.

Open science holds immense potential for neuroimaging by fostering collaboration & transparency in the neuroscience community.

Figure(s)

DATABASE	DESCRIPTION	POPULATION
Alzheimer's Disease Neuroimaging Initiative (ADNI)	Structural MRI images	Healthy & Alzheimer's disease
Glucose Imaging in Parkinsonian Syndromes (GLIMPS) project	FDG PET image database	Parkinson's disease, Alzheimer's disease, multisystem atrophy, progressive supranuclear palsy
The fMRI Data Center	fMRI datasets from published studies	Healthy
OpenNeuro	Functional, structural, diffusion MRI & MEG	Healthy & various diseases
Brain-Development.org	Structural MRI images & atlases	Fetuses, healthy & prematurely born neonates
The PAIN repository	Structural, functional, diffusion MRI & metadata	Healthy & pain conditions
BIRN fMRI & MRI data	MRI, fMRI datasets for human & mice brains	Healthy & elderly
SchizConnect	Structural, functional, diffusion MRI	Schizophrenia, bipolar disorder patients, their siblings, controls
Neuromorphometrics.com	T1 weighted MRI with labeled volumes	Healthy
Neuroscience Information Framework	Meta database of neuroscience-relevant data incorporating over 100 databases	Healthy & diseased human, mouse, rat, worm

Figure 1. This table lists some of the publicly available neuroimaging databases with their contents & demographics

Keywords

Clinical Workflow & Productivity; Educational Systems; Organizational & Professional Development