Kurtosis Imaging Network: a Collaborative, Open-Source Imaging Database

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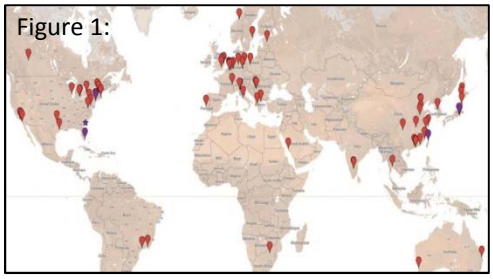
Purpose: Kurtosis Imaging Network (KIN) will create an open source database for normal healthy controls as well as various pathologies in an attempt to establish a standard range of kurtosis values within each population. This database of diffusional kurtosis images will also allow for quantitative comparisons between sites, vendors, and various protocol parameters. Finally, KIN will also help develop a strong collaborative network for researchers to troubleshoot current projects and create future projects.



Outline: Initially, we contacted 200+ researchers who had downloaded our post-processing software known as Diffusional Kurtosis Estimator (DKE)[1] and registered information in our database. Of these, 103 researchers expressed a desire to participate in the creation of KIN (Red pins in **Fig 1**). As a first project, we analyzed 10 anonymized healthy controls from 5 selected sites which varied in protocol parameters, age, and gender (Purple Pins in **Fig 1**). Demographic data and study parameters are shown in **Table 1** for each group. Participating sites include: Masaaki Hori, MD from Juntendo University (JU) School of Medicine, Toyko, Japan. Joseph Helpern, PhD from New York University (NYU), New York, NY and Medical University of South Carolina (MUSC), Charleston, SC, and Varan Govind, PhD from University of Miami (UM), Miami, FL. All images acquired at b-values of 0, 1000, and 2000 s/mm^2 were processed with DKE 2.5.1 (http://www.nitrc.org/projects/dke/). Region of interest analysis was performed by normalizing all diffusion maps to the John Hopkins white matter atlas (JHU-ICBM-FA-1mm.nii, 2010) with SPM8 (http://www.fil.ion.ucl.ac.uk/spm/). The body of the corpus callosum was used to determine the differences of fractional anisotropy (FA), mean diffusivity (Dmean), and mean kurtosis (Kmean) between groups, vendors, and protocols (**Fig 2**). One way analysis of variance was performed across groups with age as a covariate and corrected with Sidak's post hoc test (FA: $p = 0.204$, Dmean: $p = 0.547$, Kmean: $p = 0.151$). This preliminary study demonstrates that although protocol parameters and vendors differed between groups, the range of diffusion metrics were not significantly different.

Summary: This analysis of sample data submitted to KIN's imaging database demonstrates the feasibility of multiple sites used for patient recruitment and imaging in an effort to minimize study costs and increase patient study size.

Reference: 1. Tabesh A, Jensen JH, Ardekani BA, Helpern JA. Magn Reson Med. 2011;65:823-36.

Table 1: For this analysis, KIN groups include: Juntendo University (JU), New York University (NYU), Medical University of South Carolina (MUSC), University of Miami (UM). Age (mean ± standard deviation)

Group	Scanner	Subjects (n)	Age (years)	Voxel Size (mm)	Directions (n)	TE (ms)	TR (ms)
JU	Philips Achieva	10	30.5 ± 5.6	3.0x3.0x3.0	32	70	7437
NYU-Young	Siemens TIMTrio	10	17.4 ± 1.4	2.7x2.7x2.7	30	96	6200
NYU-Old	Siemens TIMTrio	10	59.3 ± 5.6	2.7x2.7x2.7	30	96	5900
MUSC	Siemens TIMTrio	10	57.8 ± 6.6	2.5x2.5x2.5	64	103	6600
UM	Siemens TIMTrio	10	21.9 ± 1.4	2.7x2.7x2.7	30	101	6100

Figure 2: A. Fractional Anisotropy (FA: p = 0.204), B. Mean Diffusivity (Dmean: p = 0.547), and C. Mean Kurtosis (Kmean: p = 0.151) from the body of the corpus callosum. Box and whisker plots (right column). One-way analysis of variance with age as covariant across groups, Sidak's post hoc test.