

nanocomposite polymer(NCP, b) Diethylene glycol (DEG) based coating material, both loaded with gadolinium(III) oxide (Gd_2O_3) nanoparticles were used. **Method and Materials:** This study would be involved with nanoparticles composed gadolinium (III) oxide, a) emulsified with a silicon-based nanocomposite polymer and b) capped with Diethylene glycol (DEG) by polyol method starting from of Gd_2O_3 large particles, leading to Gd_2O_3 nano size capping with polymers. Properties evaluation of nanoparticles were assessed previously by this group. Presently, cytotoxicity of gadolinium oxide nanoparticles in U-87 MG cancer cells was evaluated. Furthermore relaxivity of particles in U-87 cells were compared to particles in cell culture medium. **Results:** The results showed that Gd_2O_3 -labeled cells have shorter T_1 and T_2 relaxation times compared with untreated cells. The slope of r_1 relaxivity ($1/T_1$) vs. concentration curve in cell samples and ccm of Gd_2O_3 (NCP) were 10.87 and $10.60 s^{-1}mM^{-1}$ and for Gd_2O_3 (deg) were 13.99 , $13.66 s^{-1}mM^{-1}$ respectively. The slope of r_2 relaxivity ($1/T_2$) vs. concentration curve in cell samples and ccm of Gd_2O_3 (NCP) were 17.26 and $15.13 s^{-1}mM^{-1}$ and for Gd_2O_3 (deg) were 16.35 , $14.62 s^{-1}mM^{-1}$ respectively. **Conclusion:** A prominent difference in signal intensity was observed, indicating that Gd_2O_3 nanoparticles can be used as a positive contrast agent for cell labeling. No appreciable toxicity was observed with a Gd_2O_3 nanoparticles. **Conclusion:** Gadolinium-Nanocomposite Polymer Emulsion is well characterised and potentially useful positive contrast agent for magnetic resonance molecular imaging.

SU-GG-I-150

Voxel Location Dependence of Brain Metabolites as Determined by Magnetic Resonance Spectroscopy

L Ewell*, A Bhullar, B Stea, University of Arizona, Tucson, AZ

Purpose: To quantify the spatial variation of absolute metabolite concentration in the human brain as determined by magnetic resonance spectroscopy (MRS). **Method and Materials:** Multivoxel (PRESS) magnetic resonance spectroscopy data has been analyzed in an attempt to map out brain anatomy. Phantom data, along with spectra from a healthy volunteer and protocol patients were compared in order to detect trends that can be correlated with anatomy and/or disease. A 7×7 voxel grid was utilized, with a 2×2 cm voxel size along with a 1 cm slice thickness for all MRS scans. Phantom metabolites concentrations were similar to a healthy human brain: 3.0, 10.0 and 12.5 mM for Cho, Cr and NAA respectively. Gaussian fits were used to estimate peak area. **Results:** The phantom absolute voxel metabolite concentration variation is fit by a second degree polynomial, $ax^2 + bx + c$. Average R^2 (Pearson product) for the six different fits (three metabolites \times two directions) varied from 0.93 ± 0.08 (st. dev.) for the left-right fit for NAA to 0.98 ± 0.02 for the anterior – posterior fit for Cr. Absolute metabolite concentration from the healthy volunteer show a consistent trend when plotted in the left right direction with the most medial voxel having a low value of metabolite concentration, followed by a relative maximum in the mid – lateral cerebrum, with a relative minima on the most lateral voxels. This minimum is likely the result of low metabolite concentrations near the mid-hemisphere/ventricle region of the cerebrum. NAA concentrations from a protocol patient show roughly consistent functional spatial dependence for three anterior rows, with a posterior row distinct. Lactate/lipid contamination is likely the cause of this differentiation. **Conclusion:** Determining the functional spatial dependence of metabolite concentrations can aid in the deciding the value of diagnostic clinical MRS scans.

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SU-GG-I-151

Reduced Number of Signal Averages for Diffusion Imaging Using Compressed Sensing

J Miao¹*, S rayan², W Li³, X Yu⁴, D Wilson⁵, (1) Case Western Reserve University, Cleveland, Ohio, (2) Case Western Reserve University, Cleveland, Ohio, (3) Case Western Reserve University, Cleveland, Ohio, (4) Case Western Reserve University, Cleveland, Ohio, (5) Case Western Reserve University, Cleveland

Purpose: Diffusion-weighted imaging is an important clinical tool in neurological and body MRI. However, low contrast to noise ratios (CNR) of parameter maps (e.g., fractional anisotropy (FA)), force numerous signal averages to achieve useful CNR. Diffusion Tensor Imaging (DTI) requires at least six diffusion directions, which can lead to extremely lengthy protocols. Here, we present a method for using Compressed Sensing (CS)

processing to decrease the number of signal acquisitions needed to achieve a given CNR. **Method and Materials:** The CNR was calculated for the FA (Fractional Anisotropy) map of celery DTI data acquired on a 9.4T vertical Bruker BioSpec. The 2-D Fourier coefficients of FA map were first decomposed into multiple sets of incoherent subsamples by the application of complementary random masks with equal sampling ratios, such that all of the coefficients were used at least once. Data subsampling was performed in both directions. CS reconstruction was applied to each subset of Fourier coefficients to recover multiple fully sampled FA maps. Finally, the CS reconstructed FA maps were averaged (in Fourier space) to produce a less noisy FA map. **Results:** The CS processed FA maps mostly contained significantly less noise than unprocessed FA maps by both calculated CNR and visual inspection. **Conclusion:** We found that the CS processed FA maps mostly contained significantly less noise than unprocessed FA maps. However, our celery phantom datasets started out with high CNR, which does not reproduce in vivo noise conditions. Therefore, application of this method to a phantom dataset might not fully demonstrate its capabilities, meaning that the method should be tested on more realistic MR data before any practical significance can be attached to these results.

SU-GG-I-152

Rapid Evaluation of X-Ray/light Field Alignment for Digital Radiographic Systems

M Hoerner*, D Hintenlang, University of Florida, Gainesville, FL

Purpose: This study investigated the development of a device to rapidly quantify x-ray and light field alignment. The device is a useful alternative to traditional measurement techniques requiring film and is particularly useful for all-digital facilities that no longer have film processors. The system that is investigated provides rapid and accurate evaluation of the difference between x-ray and light fields. **Method and Materials:** A fiber-optic coupled (FOC) dosimetry system was adapted to evaluate the misalignment between the light and x-ray fields of mammography imaging systems. An FOC detector element providing a variable output as a function of exposed dosimeter length is used to measure the deviation of each side of the X-ray/light field. Each detector element incorporates two FOC dosimeters which were constructed by coupling plastic scintillator fibers, 500 microns in diameter, one 2mm and the other 5cm in length, to sensitive photomultiplier tubes (PMTs). The detector element is positioned such that the 5 cm dosimeter intersects the edge of the light and X-ray fields. The second dosimeter (2mm) is positioned entirely in the X-ray field to provide a relative measure of beam intensity. Characterization involved varying the length of the 5 cm dosimeter exposed within the x-ray field. **Results:** The system consistently demonstrated linearity with tube output and exposed length. Trials have shown a linear response of detected counts to length of scintillation material in the light field over the range of interest. The system's spatial resolution is evaluated and characterized for a variety of exposure parameters. **Conclusion:** Multiple PMTs allow all edges of the light field to be evaluated simultaneously, permitting x-ray/light field alignment for a typical digital mammography system to be completed in approximately ten minutes. The time savings and improved accuracy over current alternatives makes the device an attractive tool for digital mammography quality control.

SU-GG-I-153

A Novel Relevance Feedback Approach for Efficient Mammogram Image Retrieval

J Oh¹*, Y Yang², I El Naqa¹, (1) Washington University in St. Louis, St. Louis, MO, (2) Illinois Institute of Technology, Chicago, IL

Purpose: With the rapid increase of medical databases and PACS (picture archiving and communication systems) image volumes, it became critical to develop new tools to retrieve images from these archives more effectively and efficiently for routine clinical practice. A key factor for successful image retrieval systems lies in the development of efficient methods that can derive high-level semantic concepts from low-level image content features. Despite many efforts, an efficient retrieval system for medical images still remains a challenging problem due to their complex contents in relation to disease conditions. Towards this goal we have developed a machine learning framework that utilizes expert's knowledge for online retrieval of relevant mammogram images based on clustered microcalcifications. **Materials and Methods:** We tested a database of 200 clinical mammograms that were taken from 104 patients with known pathology. To automatically retrieve mammograms from the database that are perceptually similar to a given query image, we proposed an efficient relevance feedback algorithm based