BIOGRAPHICAL SKETCH

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NAME: Sun, Peng

eRA COMMONS USER NAME (credential, e.g., agency login): PSUN01

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Harbin Engineering University, Harbin, China	B.S.	08/1999	Optoelectronic Technology
Beijing Institute of Technology, Beijing, China	M.S.	04/2002	Electrical Engineering
Beijing University of Posts and Telecommunications, Beijing, China	Ph.D.	08/2005	Electrical Engineering
Washington University in St. Louis, St. Louis	Postdoctoral	01/2012	Radiology

A. Personal Statement

Diffusion MR imaging is being widely used for studying the diseases of the central nervous system (CNS). My research has been focused on the applications of diffusion MRI to investigate WM injuries in CNS, and I have been involved in a wide range of methodology developments and clinical applications on brain, spinal cord and optic nerve. This has encompassed development and implementation of novel acquisition methods and MR sequences; imaging protocol design for fast and high-resolution MR imaging; implementation of MR image post-processing pipeline. Applications include spinal cord injury (SCI), multiple sclerosis, traumatic brain injury and stroke.

B. Positions and Honors

Positions and Employment

2005-2007 Senior System Engineer, China Design Center, Networks, Motorola, Beijing
2007-2012 Postdoctoral Research Associate, Department of Radiology, Washington University School of Medicine, St. Louis
2012-2014 Senior Scientist, Department of Radiology, Washington University School of Medicine, St. Louis
2014-2017 Instructor, Department of Radiology, Washington University School of Medicine, St. Louis
2017-present Assistant Professor, Department of Radiology, Washington University School of Medicine, St. Louis

Other Experience and Professional Memberships

2018- Member, The Radiological Society of North America (RSNA)
2014- Member, International Society for Magnetic Resonance in Medicine (ISMRM)
2008- Member, Association for Research in Vision and Ophthalmology (ARVO)

C. Contributions to Science

1. Axon injury/loss, demyelination and inflammation are the primary pathologies in multiple sclerosis lesions. The roles that these individual pathological processes play in multiple sclerosis progression remain to be defined. To image the brain and detect both neurological injury and inflammation at the same time, we developed and validated a flexible multiple-diffusion tensor model called DBSI. As a key member in this project, I have been involved in developing, validating and applying this new method in translational application in MS. Pathologies of MS share similar characteristics as many other brain diseases, but more complicated, thus our success of DBSI on MS attracts attentions from many researchers in different fields, such as TBI, stroke, HIV and cancer.

a. Ye Z., George A., Wu A., Niu X., Lin J., Adusumilli G., Naismith R.T., Cross A.H., **Sun P. (✉)**, Song S.K., A Deep Learning based Diffusion Histology Imaging for Mulitple Scrolesis Lesion Classification, Annals of Clinical and Translational Neurology, 2020. doi: 10.1002/acn3.51037.
b. **Sun P.**, George A., Perantie D, Trinkaus K., Ye Z., Naismith R.T., Song S.-K., Cross A.H., Diffusion Basis Spectrum Imaging Provides Insights into Multiple Sclerosis Pathology, Neurol Neuroimmunol Neuroinflamm Mar 2020, 7 (2) e655; DOI: 10.1212/NXI.0000000000000655
c. Shirani A., **Sun P.**, Trinkaus K., Perantie D., George A., Naismith R., Song S.K., Cross A.H. Diffusion basis spectrum imaging for identifying pathologies in MS subtypes, Annals of Clinical and Translational Neurology, 2019. doi: 10.1002/acn3.50903
d. Wang Y., **Sun P.**, Wang Q., Wang X., Trinkaus K., Schmidt R. E., Naismith R. T., Cross A. H., and Song S.-K., Differentiation and quantification of inflammation, demyelination and axon injury or loss in multiple sclerosis, Brain Feb 2015, DOI: 10.1093/brain/aww046

2. In addition to translational applications in brain, I also applied DBSI on human spinal cord to predict neuroinflammation and axonal loss in acute and chronic spinal cord injury. Standard MRI sequences can provide only limited information in the absence of substantial structural abnormalities and offer no insight into preserved functional connectivity and the potential for functional improvement in SCI patients. DBSI quantified diffusion parameters of fiber tract in the spinal cord to allow accurate determination of spinal cord integrity. In addition to axon and myelin injury, the findings suggest that both inflammation and axon loss contribute to neurological impairment. DBSI derived axon volume declines as severity of impairment increases.

a. Lin TH*, **Sun P*(equal contribution**), Hallman M, Hwang FC, Wallendorf M, Ray WZ, et al. Noninvasive Quantification of Axonal Loss in the Presence of Tissue Swelling in Traumatic Spinal Cord Injury Mice. J Neurotrauma. 2019.
b. **Sun P.**, Murphy R., Gamble P., George A., Song S.K., Ray W., Diffusion Assessment of Cortical Changes, Induced by Traumatic Spinal Cord Injury. Brain Science, 2017. PMID: 28218643
c. Murphy R., **Sun P.* (equal contribution)**, Xu J., Wang Y., Sullivan S., Gamble P., Wagner J., Wright N., Dorward I., Riew D., Santiago P., Kelly M., Trinkaus K., Ray W., Song S.K., Diffusion basis spectrum imaging can quantify inflammation and edema in cervical myelopathy. Spine 2016. PMID: 26650876
d. Murphy R., **Sun P.**, Han R., Griffin K., Wagner J., Wright N., Dorward I., Kelly M., Riew D., Santiago P., Zebala L., Trinkaus K., Ray W., Song S.K., Fractional Anisotropy to Quantify Cervical Spondylotic Myelopathy Severity, Journal of Neurosurgical Sciences 2016, PMID: 27149369

3. I have been working on the studies of using in-vivo diffusion MRI and MEMRI as a noninvasive tool for assessing the pathogenesis of optic nerve pathologies in both animals and human. In-vivo DTI and DBSI was used to longitudinally assess the progression of damaged optic nerve in mice. DTI accurately detected the progression of optic nerve injury in vivo and the observed changes were correlated with histology-determined RGC axon damage. But we also noticed that DTI failed at the acute stage due to the occurrence of inflammation. DBSI has successfully differentiated and quantified axon and myelin injury from cellular inflammation and edema, correlating with visual acuity in optic neuritis of experimental autoimmune encephalomyelitis (EAE) mice with post-MRI histological validation. Manganese enhanced MRI (MEMRI) has recently been used as a biomarker and tracer to investigate optic nerve axonal integrity. We found intravitreal MnCl2 injection provides more reproducible results with less adverse side effects than topical loading.

a. Zhang X., **Sun P. (equal contribution)**, Wang J., Wang Q., Song S.K., Diffusion Tensor imaging detects retinal ganglion cell axon damage in the mouse model of optic nerve crush, Invest Ophthalmol Vis Sci. 2011 Sep 1;52(9):7001-6. PMCID:PMC3175987

b. Kim J.-W., Andersson L.J., Seifert A., **Sun P.**, Song S.-K., Dula C.; Naismith R. T., Xu J., Incorporating non-linear alignment and multi-compartmental modeling for improved human optic nerve diffusion imaging. NeuroImage. 2019; 196: 102-13

c. Lin T.H., Chiang C.W., Perez-Torres C.J., **Sun P**, Wallendorf M., Schmidt R.E., Wang Y., Cross, A.H., Song S.W., Diffusion MRI quantifies early axonal loss in the presence of nerve swelling, J Neuroinflammation. 2017 Apr 7;14(1):78. doi: 10.1186/s12974-017-0852-3.

d. Lin T.-H., Chiang C.-W., Trinkaus K., Spees W. M., **Sun P**. and Song, S.-K., Manganese-enhanced MRI (MEMRI) via topical loading of Mn2+ significantly impairs mouse visual acuity: a comparison with intravitreal injection. NMR Biomed. 2014 doi: 10.1002/nbm.3073

Complete List of Published Work in MyBibliography:
https://www.ncbi.nlm.nih.gov/myncbi/1-A0Pnz0ccC1xI/bibliography/public/

D. Additional Information: Research Support and/or Scholastic Performance

Research Support

R01HL129241 Ford, An (PI) 7/4/2020-6/30/2024
MR-Derived Cerebral Oxygen Metabolism underlying Ischemic Vulnerability in Sickle Cell Disease
Due to HbS polymerization in erythrocytes, chronic hemolytic anemia and multiple downstream effects, individuals are at ongoing risk of tissue hypoxia systemically. Neurological complications include stunted brain growth, cerebral infarction, and cognitive decline, resulting in failure to reach academic milestones and maintain employment. This project will focus to adults with SCA, as a growing and understudied population to determine if cerebral oxygen metabolic stress predicts ischemic brain injury/cognitive decline and investigate two mechanisms (neuro-inflammation and CFH) to further our understanding of oxygen supply-demand mismatch in SCA.
Role: Co-Investigator

R01NS047592 Zack, Song (PI) 04/01/05-06/30/22
Predictive Value of Diffusion MRI in Cervical Spondylotic Myelopathy
A major shortcoming limiting efforts to improve the treatment of patients with CSM is the lack of quantifiable metrics on which to base clinical decisions. The long-term objective of this proposal is to establish and validate non-invasive imaging biomarkers that are predictors of clinical course and therapeutic response to surgical decompression in patients with CSM. The identification and validation of non-invasive DBSI biomarkers will provide guidance on clinical management, long-term prognosis, and family counseling.
Role: Co-Investigator

R01NS099527 Inglese (PI) 09/01/17-06/30/21
Examining the Role of Brain Sodium Content in Multiple Sclerosis Using MRI
Accumulation of intra-axonal sodium ions was suggested to represent a key factor in the degenerative process and that partial blockade of sodium channels protects axons from degeneration in experimental models of MS. The aims of this proposal are to measure sodium concentration invivo, determine the role of excess brain sodium accumulation in neuro-axonal injury and correlate Sodium MR Imaging with diffusion basis spectrum imaging (DBSI). The proposed research will advance our understanding of the pathophysiology of neurodegeneration in MS, and will help identify potential novel outcome measures of disease progression.
Role: Co-Investigator

Completed Research Support

The Missouri Spinal Cord Injuries Research Program Zack, Sun (PI) 10/01/15-09/20/17

Diffusion basis spectrum imaging predicts neuroinflammation and axonal loss in acute and chronic spinal cord injury
Cervical Spondylotic Myelopathy (CSM) is a significant public health problem. A major shortcoming limiting efforts to improve the treatment of CSM is the lack of quantifiable metrics on which to base clinical decisions. The overall goal of this proposal is the clinical validation of DBSI as a non-invasive biomarker capable of more accurate measurement of SCI severity and predicting functional outcome.
Role: Co-Principle Investigator

P01NS059560 Cross (PI) 05/01/14-04/30/19
Biomarkers and Pathogenesis of MS: From Mouse to Human
Better understanding of the mechanisms of MS progression, and what underlies the continued axonal damage and dropout would help guide development of new therapeutics for this common disease. The goal of this project is to develop and test novel cutting edge noninvasive and specific MRI biomarkers of white matter injuries using animal models, human tissues, and MS patients.
Role: Co-Investigator

U01EY025500 Song (PI) 04/01/15-03/31/20
Imaging optic nerve function and pathology: from mouse to human
The goal of this project is to deliver a new, diffusion MRI based method to assess optic nerve anatomy, function and pathology simultaneously in both mice and human subjects. This approach will be validated by monitoring the progression and/or regression of axonal damage in glaucoma and optic neuritis.
Role: Co-Investigator

RG5258A5 Song (PI) 10/01/14-09/30/17
Understanding the pathophysiology underlying MS progression
Improving the visualization of damage to the optic nerve in an MS model to better understand MS progression.
Role: Co-Investigator

R21NS090910 Naismith (PI) 09/01/14-07/17/16
Noninvasively Distinguishing Inflammation from Tissue Injury in Optic Neuritis
Therapeutic agents of neural protection and repair in multiple sclerosis (MS) require proof-of-concept studies in model human systems to evaluate evolving histopathologic processes. The goal of this project is to apply the DBSI method to human optic nerve imaging to create a complete acquisition/analyses package available to multiple centers for collaborative trials.
Role: Co-Investigator