



Funded by
the European Union

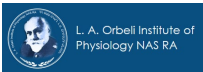


ERA Chair Project

**“Regional Center of Excellence at
the Orbeli Institute of Physiology”**

Funding: 5 years (2023-27), €2.4mln

By Narine Sarvazyan, PhD



Horizon Europe ERA Chair, L.A.Orbeli Institute of Physiology



William Frazer Endowed Chair, American University of Armenia



Professor, The George Washington University School of Medicine

“Regional Center of Excellence at the Orbeli Institute of Physiology”

Funding: 5 years (2023-27), €2.4mln

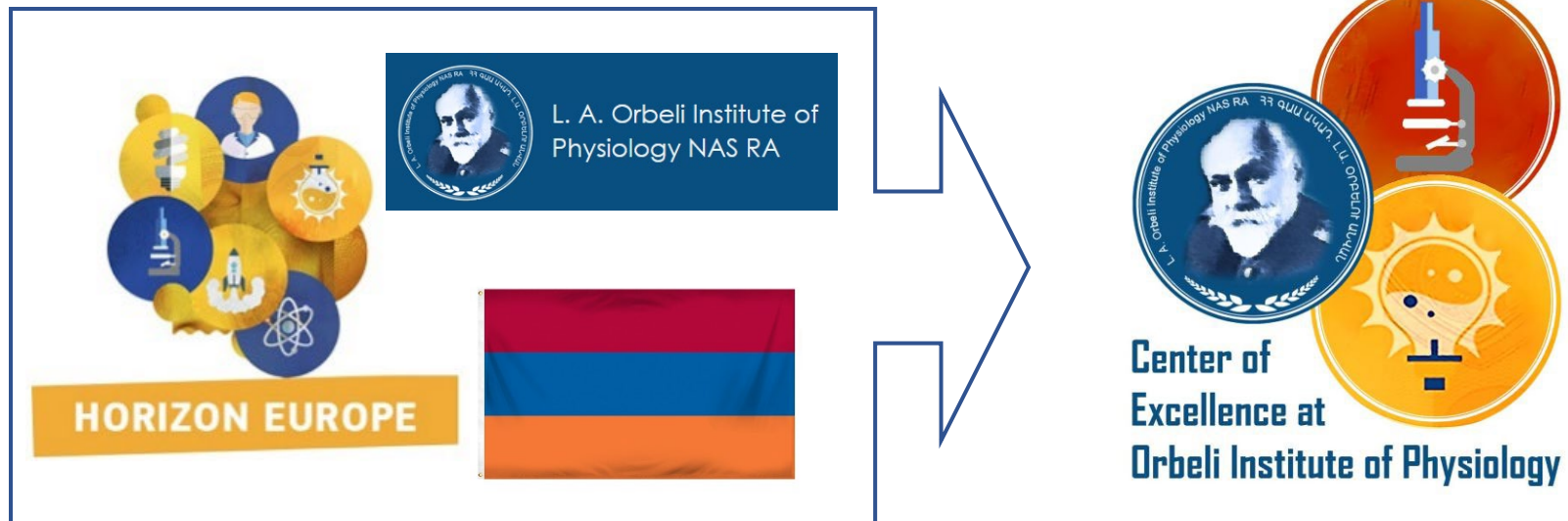
RESEARCH

EDUCATION

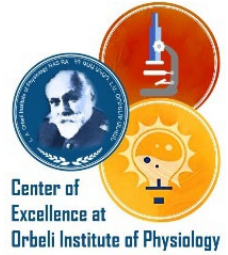
COMPLIANCE

INFRASTRUCTURE

The Project aims to enhance the research environment in the Orbeli Institute of Physiology, one of the first institutions of the Armenian Academy of Sciences



Key objectives



- ***Establishment of a new research group focused on hyperspectral imaging of biological targets***
- ***Improvements in institutional infrastructure, including the vivarium***
- ***Compliance with EU standards in animal use, biosafety, and human subjects research***
- ***Trainings in bioimaging, data analysis, poster and oral presentations***

<https://era-chair.am>



Center of
Excellence at
Orbeli Institute of Physiology

Search



[HOME](#) [OUR TEAM](#) [COMPLIANCE](#) [RESOURCES](#) [NEWS](#) [GALLERY](#) [CONTACT](#)

ERA Chair Project

REGIONAL CENTER OF EXCELLENCE AT THE ORBELI INSTITUTE OF
PHYSIOLOGY

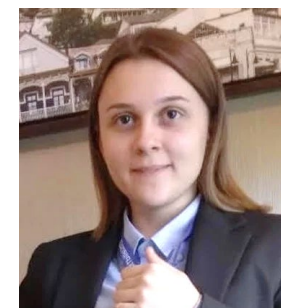


ERA Chair Science Team:

Narine
Sarvazyan



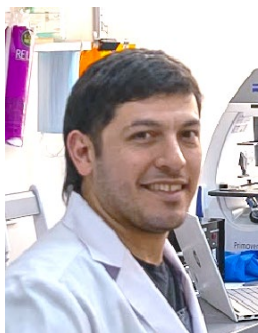
Narek Meloyan



Kristina

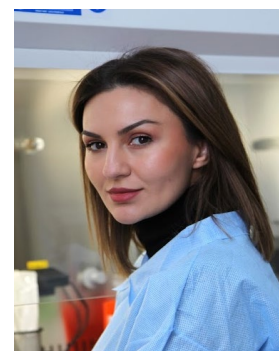
Ghahramanyan

Fernando
Villarruel, PhD



Katya
Baydiuk, PhD

Tigran
Sghomonyan



Ani Avetisyan

Narek
Chilingarian



ERA Chair Admin Team

Mariam Sianozova



Managing Director

Evelina Harutunyan



Admin Assistant

Garegin Muradyan



Webmaster

Host & Coordinator



Naira Ayvazyan, D.Sc

Bioimaging Instructors



Gevorg Gukasyan



Sergei Fedotov



Daniel Polianczyk

Institutional IT support

*Members of different
committees*

COMPLIANCE

Ethics and Compliance Committee >

Laboratory Safety

Animal Care & Use

Animal Care and Use Trainings

Biosafety

Research Involving Human Participants



ANIMAL CARE & USE

BIOSAFETY

HUMAN SUBJECTS RESEARCH

Ethics and compliance in research cover a broad range of activity from general principles for conducting research responsibly to specific regulations governing particular type of research. These principles are essential for ensuring that research is conducted in a manner that is both responsible and credible, while also safeguarding the rights and well-being of participants and maintaining the trust of stakeholders

Compliance refers to the adherence to established guidelines or specifications, or the process of achieving such adherence.

ANIMAL CARE & USE

ANIMAL CARE & USE

Institutional Animal Care and Use
Committee

Occupational Health and Safety

PROTOCOL SUBMISSION

POLICIES AND INFORMATION MATERIALS

RESOURCES

SOP



The L.A.Orbeli Institute of Physiology conducts research involving animals to better understand health and diseases in humans and animals, as well as to contribute into development of new treatments. The Institute is committed to ensure proper animal care and use, training of the staff involved, careful planning of experiments, and taking all efforts to mitigate pain and distress for the animals.

An animal care and use (ACU) program at the Orbeli Institute of Physiology comprises all activities that have a direct impact on the animals' welfare, including animal and veterinary care, policies and procedures, personnel management, occupational health and safety, IACUC functions, animal facility design and management. The use of laboratory animals is governed by the regulatory requirements outlined in the Article 11 of the Republic of Armenia Law about veterinarian care approved on June 21, 2014 and comply with the Directive 2010/63/EU of the European Parliament and of the Council on the protection of animals used for scientific purposes and the European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes.



Lab space
renovation:
>200m³





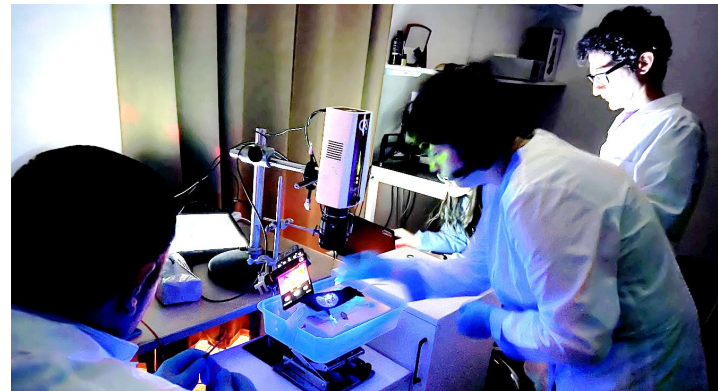
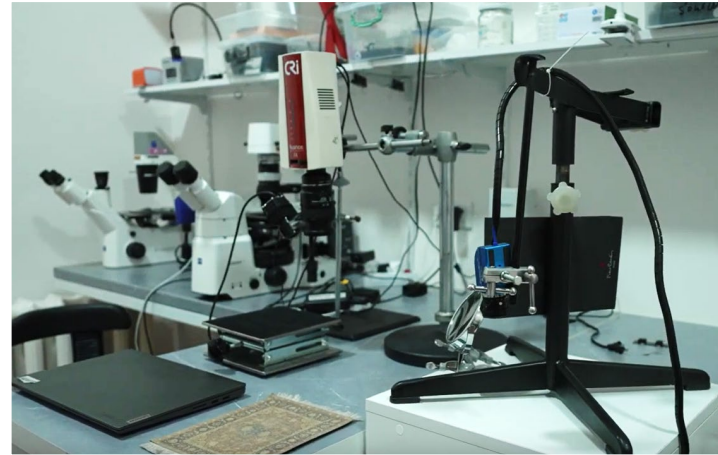






Spectroscopy and Hyperspectral Imaging Instruments and Accessories:

- UV-Vis Spectrophotometer for measuring absorption and transmittance in samples across ultraviolet and visible light spectrums. Must feature a broad wavelength range and high spectral resolution.
- Relevant accessories like cuvette holders, fiber optic probes
- Tunable UV/Broadband/IR Xenon Light Source LED Arrays for tissue illumination w UV and white light
- Fast snapshot hyperspectral camera
- Frame-Based Hyperspectral Imaging Systems in UV, VIS and NIR ranges
- High-performance computing solutions with data analysis and visualization software specific to spectroscopic analysis (e.g., MATLAB, R with spectral analysis packages, and proprietary software bundled with instruments)



Equipment for Tissue Engineering and Cell Culture studies

- Biosafety cabinet for sterile work environments
- Two stacked CO2 Incubators to maintain cell culture conditions
- Microscope with phase-contrast capabilities for cell inspection
- Centrifuges for sample preparation
- Water distiller
- Liquid Nitrogen Storage for cell preservation
- Autoclaves for equipment sterilization
- Refrigerator and freezer for reagent and sample storage
- Water baths and heat blocks for sample incubation
- Perfusion pump for decellularization
- Pipettes, cell culture flasks, dishes, and multi-well plates
- Dissection tools
- Fluorescent dyes and probes
- Cell culture media and reagents
- Tissue culture plates and flasks
- Antibiotics and growth factors
- Microscope slides and coverslips
- Chemicals and biochemical reagents



Spectral pixels as images: CNN-based pixel classification of 4D hyperspectral data for nerve and ligament differentiation

Naira Matosyan^{a,b}, Narek Chilingaryan^c, Narine Sarvazyan^{a,c,d}, and Varduhi Yeghiazaryan^a

^aAmerican University of Armenia, Yerevan, Armenia

^bYerevan State University, Yerevan, Armenia

^cL. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

^dGeorge Washington University, Washington, DC, United States

Hyperspectral imaging is a capture rich information from tissues based on their flux interest in the surgical setting with several consecutive response in the visible light into tissue classification from matrices of individual pixels. We test our approach on a variable imaging condition used as training data. We sensitivity to changes in the superior by 10.4%, on average hyperspectral images.

Keywords: 4D hyperspec

DEEP LEARNING CLASSIFICATION OF ABLATED ATRIAL TISSUE IN SPECTRALLY ENHANCED HYPERSPECTRAL IMAGES

Arpi Hunanyan^{1*}, Nazeli Ter-Petrosyan^{1*}, Fernando Villarruel², Tigran Soghomonyan¹, Narine Sarvazyan^{1,2,3}, Varduhi Yeghiazaryan¹, and Aram Butavayan¹

¹Akian College of Science and Engineering, American University of Armenia, Yerevan,

²L. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

³George Washington University, Washington, DC, United States

ABSTRACT

Text here

analysis of 45 deep learning (DL) classification for identifying ablated regions in atrial tissue. Building on traditional hyperspectral met

4D hyperspectral imaging for intraoperative tissue classification

Narek Chilingaryan^a, Fernando Villarruel^a, Tigran Soghomonyan^a, Varduhi Yeghiazaryan^b, and Narine Sarvazyan^{a,b,c}

^aL. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

^bAmerican University of Armenia, Yerevan, Armenia

^cGeorge Washington University, Washington, DC, United States

ABSTRACT

This study examines the use of 4D hyperspectral imaging (4D HSI) for visualizing clinically relevant targets. The approach relies on intrinsic optical properties of the tissue without the need for exogenous dyes or contrast agents. Here we compare autofluorescence-based 4D HSI to a traditional 3D HSI approach for its ability to distinguish between nerve and ligament bundles, isolated from adult cow trotters. Datacubes are captured within the 420–720 nm interval, under illumination wavelengths ranged from 280 to 420 nm. The unmixing outcomes of individual 3D HSI cubes prove inferior to those from multiple, even as few as three, 3D cubes sequentially combined into one. The data show an increase in the ratio of correctly identified pixels with the increased number of HSI cubes taken at different excitation wavelengths. Combining multiple 3D HSI cubes into a single 4D dataset improves target identification and reveals additional features, such as damaged nerve with torn epineurium. The 4D HSI approach merges excitation-emission matrices with traditional HSI and delivers higher accuracy in distinguishing different tissue structures. Furthermore, more advanced analysis techniques, such as deep neural networks, can potentially utilize 4D HSI data further to distinguish surgical targets. The data suggests that 4D HSI has significant potential for various clinical applications, including surgical procedures, dental applications, and cancerous lesion identification, leveraging small spectral changes for improved visualization and clinical outcomes.

Keywords: 4D hyperspectral imaging, excitation-emission matrices, surgery

1. INTRODUCTION

This study builds upon earlier efforts by us and others to use the intrinsic optical properties of tissues for visualization of clinically relevant targets without the need for exogenous dyes or contrast agents.^{1–4} Here we explore the advantages of the 4D hyperspectral imaging (4D HSI) modality that collects and processes data acquired from both excitation and emission axes. Recent advances in optics, such as fast tunable light sources and snapshot cameras, made the 4D HSI approach suitable for intraoperative monitoring of the surgical field-of-view. Each 4D HSI dataset contains values from four axes: two spatial dimensions (x and y) and two spectral dimensions (excitation and emission wavelengths). This study compares the performance of autofluorescence-based 4D HSI to the traditional emission-based 3D HSI approach. Excised bovine nerve and ligament bundles were used as examples of targets to be distinguished in order to allow to avoid inadvertent nerve damage during surgery. Such damage can result from inter-patient anatomical variability and visual similarity of nerve fibers to nearby structures, posing significant risks including loss of sensation and paralysis.⁵ This study highlights the potential of the 4D HSI approach as a promising candidate for developing new imaging methods to distinguish nerves intraoperatively.

Further author information: (Send correspondence to N.S.)

N.Ch.: narek.chilingaryan@physiol.sci.am F.V.: villarruel.fernando@physiol.sci.am

T.S.: tsoghomonyan@physiol.sci.am V.Y.: yeghiazaryan@aua.am N.S.: phymas@gwu.edu

COMBINING 4D HYPERSPECTRAL IMAGING WITH CNN FOR NERVE AND LIGAMENT DIFFERENTIATION

Naira Matosyan^{a*}, Narek Chilingaryan^{b*}, Narine Sarvazyan^{a,b,c}, Varduhi Yeghiazaryan^a

^aAmerican University of Armenia, Akian College of Science and Engineering, Yerevan, Armenia

^bL. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

^cGeorge Washington University, Washington, DC, United States

ABSTRACT

Iatrogenic nerve injuries, inadvertently caused by an operating physician, occur at a significant annual rate. A major reason for such intraoperative damage is poor nerve visualization, which results in the transection of incorrect structures or the misidentification of nerves as vessels or ligaments. Previously, diffuse reflectance-based hyperspectral imaging (HSI) has been applied to the nerve differentiation issue in the surgical context. In contrast, our study addresses the task of differentiating between nerves and ligaments using 3D and 4D autofluorescence HSI, followed by classification using CNN and linear unmixing. Our experiments use excised bovine nerve and ligament samples. The data indicate that utilizing a 4D HSI configuration increases classification performance by up to 10%, achieving nearly 98.9% accuracy in most cases. Furthermore, CNNs consistently outperform linear unmixing, at times by more than 15%. We conclude that combining multiple autofluorescence HSI datacubes acquired at several narrow-band excitation wavelengths with a CNN approach enables superior differentiation between n

at times//g

Index
ing, linear

Iatrogenic
physician
dergoing i
cases are r
erative an
are divers
nerves be
not correc
treme cas
tensions, h
ing the IB

*These ar

MULTIEXCITATION HYPERSPECTRAL IMAGING TOWARD IMPROVED LICHEN IDENTIFICATION

Narek Chilingaryan¹, Arsen Gasparyan^{2,3}, Narine Sarvazyan^{1,2,4}

¹Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

²American University of Armenia, Yerevan, Armenia

³Institute of Botany after A. Takhtajyan NAS RA, Yerevan, Armenia

⁴George Washington University, Washington, DC, United States

ABSTRACT

Hyperspectral imaging (HSI) has significantly advanced the identification and characterization of biological specimens by utilizing high-resolution data across multiple spectral bands. In the study of lichens, which are symbiotic entities formed by fungi and photosynthetic partners, our novel approach leverages the potential of HSI through a technique referred to as multi-excitation HSI (ME-HSI). This method differentiates itself by employing multiple ultraviolet wavelengths for illumination, capturing data in the visible range, and subsequently integrating these hyperspectral cubes. Our research demonstrates that this innovative technique provides superior effectiveness in identifying lichen species. By detailing unique spectral signatures, ME-HSI facilitates species differentiation, enhancing the accuracy of ecological monitoring and conservation efforts through non-invasive methods.

Index Terms— Hyperspectral Imaging, Autofluorescence, Lichenology, Taxonomy, Environment

1. INTRODUCTION

Lichens play a critical role as bioindicators due to their sensitivity to environmental changes and pollutants. They contribute to ecosystem health by participating in nutrient cycling and soil formation [1]. In Armenia, a region with diverse climatic zones and rich biodiversity, the accurate identification and monitoring of lichens are particularly crucial [2]. Lichen diversity in Armenia not only reflects the region's unique ecological conditions but also provides insights into environmental changes and the impacts of anthropogenic activities. However, identifying different lichen species is notoriously difficult given their visual similarities and complex structures [3]. Our research seeks to address these needs by advancing identification methods through multi-excitation hyperspectral imaging (ME-HSI). In the past, reflectance-based hyperspectral imaging has shown to be effective for daylight aerial monitoring of lichen growth and distribution [4]. However, this approach works only for lichen species that exhibit significant differences in their reflectance spectra, i.e., their

color. Yet many species of lichens are indistinguishable by color in which case additional physical factors or properties need to be explored.

The ability to rapidly and straightforwardly differentiate species using HSI is especially useful for researchers focused on ecological monitoring, biodiversity, lichen conservation efforts and sustainable ecosystem management. Here we focus on the use of ME-HSI, which employs multiple ultraviolet and visible wavelengths to illuminate the samples while capturing images in the visible range. Using this approach, we attempted to differentiate three species of lichens that are visually indistinguishable color-wise. The data have confirmed the enhanced capacity of ME-HSI to reveal subtle spectral differences. Our findings support the use of ME-HSI for ecological and preservation purposes, going beyond current remote sensing paradigms.

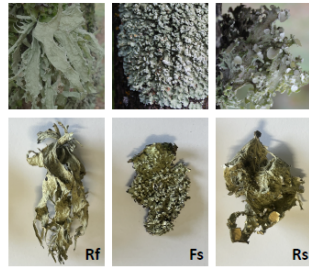


Fig. 1: Images of three lichen species in the wild and as a dried specimen. Label Rf stands for Ramalina fraxinea, Fs for Flavopunctelia soredica, and Rs for Ramalina sinensis. Upper row photographs are courtesy of Naira Sargsyan.

IEEE Access

Date of publication xxxx 00, 0000, date of current version xxxx 00, 0000.

Digital Object Identifier 10.1109/ACCESS.2023.6122000

Comparative Analysis of Deep Learning Methods for Classification of Ablated Regions in Hyperspectral Images of Atrial Tissue

Yeva Gabrielyan¹, Arpi Hunanyan¹, Sona Bezirganyan¹, Lusine Davtyan¹, Ani Avetisyan², Narine Sarvazyan^{1,2,3}, Aram Butavayan¹, and Varduhi Yeghiazaryan¹

¹Akian College of Science and Engineering, American University of Armenia, Yerevan, Armenia

²L. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia

Open Union (ERA Chair

Viability gaps between important for successful visualizing RFA-affected open. We comparatively remote sensing. We texts. We deploy a pre-biove samples. The 45 tive and subjective. For areas of known classes illable. For both porcine r performance. The best participants to rate RGB is assessed on the whole tissue. Our comparative for HSI classification of SI for surgical guidance

networks, deep learning, works.

han color images, leading to active HSI's fields [1], ranging from agriculture [2] to biomedical tissue analysis [4]. Hyperspectrally been utilized for the inspection of ablated regions on heart atrial tissue [5]—ed by the potential of HSI to reveal the mage during surgical RF ablation inter-curate estimation of RF ablation imprt guidance to reduce the risk of atrial urrence [5].

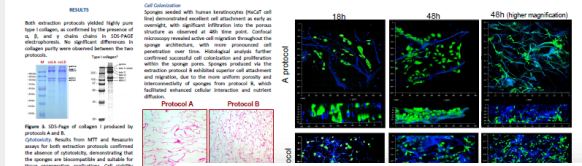
work of [5]–[7], we focus on the task fication of intact and RF ablated regions of atrial tissue using deep learning (DL).

Optimization of collagen sponges for skin repair and wound healing

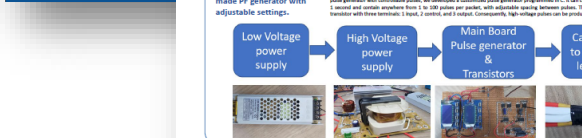
Ani Avelisyan^a, Ekaterina Baiduk^a and Narine Sarvasyan^{a,c,d}

^a A. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia
^b School of Evolutionary Physiology and Biochemistry, NAS RA, Yerevan, Armenia
^c American University of Armenia, Yerevan, Armenia
^d George Washington University, Washington, DC, United States

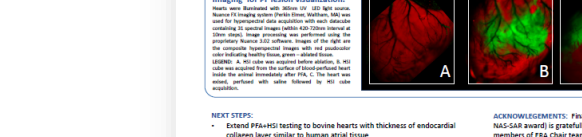
INTRODUCTION
 Collagen type I is the predominant extracellular matrix component in skin. A critical determinant in regenerative medicine, particularly for dermal tissue engineering, is the development of porous scaffolds that mimic the native extracellular matrix. The availability of natural collagen sponges remains controversial, as high-purity collagen sponges are difficult to produce. This study focuses on optimizing the process of generating collagen sponges using naturally available resources, such as bovine dermis, with an emphasis on their structural integrity and mechanical properties critical for wound healing. To establish a robust extraction process, we first refined the methodology using rat tail collagen, setting the stage for future scalability with bovine dermis as the primary source.



RESULTS
 Both extraction protocols yielded highly porous collagen sponges. Protocol A, using bovine dermis, resulted in sponges with significantly larger pore sizes (p < 0.05) compared to Protocol B, which used rat tail collagen. The pore sizes were characterized by a bimodal distribution, with peaks at approximately 100 μm and 200 μm. The sponges were biocompatible and suitable for tissue regeneration applications. The mechanical properties of the sponges were characterized by their compressive strength, which was significantly higher in Protocol A sponges (p < 0.05). The results of the histological analysis are presented in Figure 1, showing the sponge structure at different magnifications. The pore size and volume data are shown in Figure 2. The results indicate that Protocol A is more effective in producing sponges with larger pores and higher mechanical strength.



CONCLUSIONS
 Our findings highlight the potential of using natural collagen sponges for skin repair and wound healing. The optimization of the extraction process is crucial for achieving sponges with the desired structural and mechanical properties. The results of this study provide a foundation for future research on the use of collagen sponges in regenerative medicine.



ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

Exploring Multidimensional Hyperspectral Imaging for Detection of Cardiac Radiofrequency Ablation Lesions

Fernando Villanuel^a, Tigran Soghomonian^a, Narine Sarvasyan^a

^a Orbeli Institute of Physiology of the National Academy of Sciences, Yerevan, Armenia

INTRODUCTION
 Hyperspectral imaging (HSI) captures a 3D hyperspectral (x, y, λ) containing reflectance or fluorescence spectra for each pixel in an image (x, y, λ). It is a useful tool for biomedical applications, including the potential to detect and non-invasive heart lesions (1-3), with promising results. Use of a tunable light excitation source allows to expand a traditional 2D HSI to also including excitation wavelength, creating a 4D hyperspectral (x, y, λ, λ_{exc}). Due to its diverse spectral information, 4D HSI has the potential to boost the discrimination ability of this approach. However, 4D-HSI setup requires a large and complex datasets that require accurate data manipulation and analysis techniques. This work focuses on the exploration of software analysis techniques for the decomposition of dataset, and non-invasive blood and tissue based on acquired 4D-HSI datasets, and comparing to the 3D approach.

Materials and methods
 Inverted collection and RFA: The volume heart was obtained by perfusing the heart with saline and immediately excised for RFA. The heart was sectioned into 1 mm slices. The slices were stained with H&E and mounted on glass slides. The slices were imaged using a 4D-HSI setup. The 4D-HSI setup consists of a tunable light source, a camera, and a spectrometer. The 4D-HSI setup was used to acquire 4D-HSI datasets. The 4D-HSI datasets were analyzed using software analysis techniques. The software analysis techniques included the decomposition of dataset, and non-invasive blood and tissue based on acquired 4D-HSI datasets, and comparing to the 3D approach.



RESULTS
 The 4D-HSI dataset was analyzed using software analysis techniques. The software analysis techniques included the decomposition of dataset, and non-invasive blood and tissue based on acquired 4D-HSI datasets, and comparing to the 3D approach. The results of the software analysis techniques are presented in Figure 1. The results indicate that the 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of cardiac radiofrequency ablation lesions.

CONCLUSIONS
 The results of this study indicate that 4D-HSI is a promising tool for the detection of cardiac radiofrequency ablation lesions. The 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of cardiac radiofrequency ablation lesions.

ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

REFERENCES
 1. Villanuel, F., et al. "Pulsed field ablation in patients with persistent atrial fibrillation." *Journal of the American College of Cardiology* 70 (2018): 2069-2080.
 2. Soghomonian, T., et al. "Evaluation of pulsed field ablation lesion characteristics using an in vitro reproducible model." *Journal of Interventional Cardiac Electrophysiology* 2020: 1-8.

CONTACT INFORMATION
 Contact Details: N. Sarvasyan, n.sarvasyan@phs.nas.am, n.sarvasyan@phs.am

Comparative Analysis of 4D and 3D Hyperspectral Imaging for Nerve and Ligament Differentiation

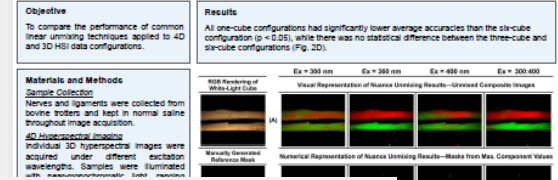
Narek Chilingaryan^a, Fernando Villanuel^a, Narine Sarvasyan^a, and Vardah Yeghiazaryan^a

^a A. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia
^b American University of Armenia, Yerevan, Armenia
^c George Washington University, Washington, DC, United States

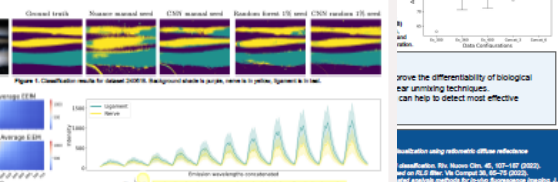
INTRODUCTION
 Accidental nerve damage, known also as iatrogenic nerve injury (INI), presents a major morbidity amongst patients undergoing especially complex surgeries. Each year, 400,000 to 600,000 INI cases occur in the US only. Still, intraoperative detection of nerves relies mostly on the surgeon's visual assessment [1].

Objective
 To compare the performance of common linear unlearning techniques applied to 4D and 3D HSI data configurations.

Materials and Methods
 Nerve and ligament samples were collected from bovine trotters and kept in normal saline throughout image acquisition. 4D Hyperspectral Imaging: Individual 3D hyperspectral images were acquired under different excitation wavelengths. Samples were illuminated with monochromatic light sources.



RESULTS
 All one-cube configurations had significantly lower average accuracies than the six-cube configuration (p < 0.05), while there was no statistical difference between the three-cube and six-cube configurations (p = 0.20).



CONCLUSIONS
 The results of this study indicate that 4D-HSI is a promising tool for nerve and ligament differentiation. The 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of nerve and ligament differentiation.

ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

REFERENCES
 1. Chilingaryan, N., et al. "Pulsed field ablation in patients with persistent atrial fibrillation." *Journal of the American College of Cardiology* 70 (2018): 2069-2080.
 2. Soghomonian, T., et al. "Evaluation of pulsed field ablation lesion characteristics using an in vitro reproducible model." *Journal of Interventional Cardiac Electrophysiology* 2020: 1-8.

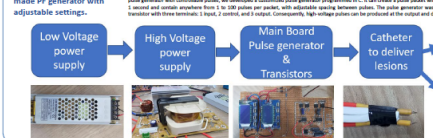
CONTACT INFORMATION
 Contact Details: N. Sarvasyan, n.sarvasyan@phs.nas.am, n.sarvasyan@phs.am

Toward imaging of PFA lesions: development of a custom-made pulsed field generator

Soghomonian Tigran^a, Avagyan Vahag^a, Grigorian Vardan^a, Sarvasyan Narine^{a,c,d}

^a A. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia, ^b National Polytechnic University of Armenia, Yerevan, Armenia, ^c American University of Armenia, Yerevan, Armenia, ^d George Washington University, Washington, DC, USA, ^e American University of Armenia, Yerevan, Armenia

INTRODUCTION
 The rapid advancement in surgical ablation techniques has underscored the need for precise and reliable imaging methods to assess lesion formation. Particularly in the context of pulsed-field ablation (PFA), the development of high-resolution, real-time imaging techniques is crucial for ensuring the safety and efficacy of the procedure. This study focuses on the development of a custom-made pulsed field generator (PFG) for the non-invasive imaging of PFA lesions. The PFG is designed to deliver high-voltage, short-duration pulses to the tissue, which are used to create and image the lesions. The PFG is composed of a high-voltage power supply, a pulse generator, and a catheter. The PFG is used to deliver pulses to the tissue, which are used to create and image the lesions. The PFG is designed to be used in a clinical setting, where it can be used to deliver pulses to the tissue, which are used to create and image the lesions.



RESULTS
 The PFG was used to deliver pulses to the tissue, which are used to create and image the lesions. The PFG is designed to be used in a clinical setting, where it can be used to deliver pulses to the tissue, which are used to create and image the lesions. The PFG is designed to be used in a clinical setting, where it can be used to deliver pulses to the tissue, which are used to create and image the lesions.

CONCLUSIONS
 The results of this study indicate that the custom-made pulsed field generator is a promising tool for the non-invasive imaging of PFA lesions. The PFG is designed to be used in a clinical setting, where it can be used to deliver pulses to the tissue, which are used to create and image the lesions.

ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

REFERENCES
 1. Sarvasyan, N., et al. "Pulsed field ablation in patients with persistent atrial fibrillation." *Journal of the American College of Cardiology* 70 (2018): 2069-2080.
 2. Soghomonian, T., et al. "Evaluation of pulsed field ablation lesion characteristics using an in vitro reproducible model." *Journal of Interventional Cardiac Electrophysiology* 2020: 1-8.

Spectral Pixels as Images: CNN-based Pixel Classification of 4D Hyperspectral Data for Nerve and Ligament Differentiation

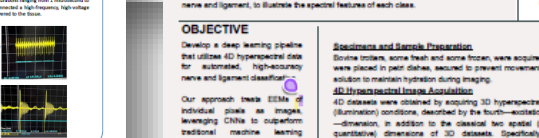
Narine Sarvasyan^a, Narek Chilingaryan^a, Narine Sarvasyan^a, and Vardah Yeghiazaryan^a

^a American University of Armenia, Yerevan, Armenia
^b A. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia
^c George Washington University, Washington, DC, United States

INTRODUCTION
 The application of hyperspectral imaging (HSI) is expanding across various fields. To enhance object discrimination, HSI data is extended with a fourth dimension—temporal [1], spatial [2], or spectral [3]. Using different extensions, several conventional combined multiple 3D hyperspectral images into one 4D dataset. This data the detection of fluorescence that require multiple illumination settings.

Objective
 To compare the performance of common linear unlearning techniques applied to 4D and 3D HSI data configurations.

Materials and Methods
 Nerve and ligament samples were collected from bovine trotters and kept in normal saline throughout image acquisition. 4D Hyperspectral Imaging: Individual 3D hyperspectral images were acquired under different excitation wavelengths. Samples were illuminated with monochromatic light sources.



RESULTS
 The 4D-HSI dataset was analyzed using software analysis techniques. The software analysis techniques included the decomposition of dataset, and non-invasive blood and tissue based on acquired 4D-HSI datasets, and comparing to the 3D approach. The results of the software analysis techniques are presented in Figure 1. The results indicate that the 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of nerve and ligament differentiation.

CONCLUSIONS
 The results of this study indicate that 4D-HSI is a promising tool for nerve and ligament differentiation. The 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of nerve and ligament differentiation.

ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

REFERENCES
 1. Chilingaryan, N., et al. "Pulsed field ablation in patients with persistent atrial fibrillation." *Journal of the American College of Cardiology* 70 (2018): 2069-2080.
 2. Soghomonian, T., et al. "Evaluation of pulsed field ablation lesion characteristics using an in vitro reproducible model." *Journal of Interventional Cardiac Electrophysiology* 2020: 1-8.

Validation of machine learning techniques for nerve and ligament differentiation

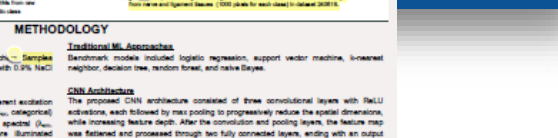
Narine Sarvasyan^a, Narek Chilingaryan^a, Narine Sarvasyan^a, and Vardah Yeghiazaryan^a

^a American University of Armenia, Yerevan, Armenia
^b A. A. Orbeli Institute of Physiology NAS RA, Yerevan, Armenia
^c George Washington University, Washington, DC, United States

INTRODUCTION
 The application of hyperspectral imaging (HSI) is expanding across various fields. To enhance object discrimination, HSI data is extended with a fourth dimension—temporal [1], spatial [2], or spectral [3]. Using different extensions, several conventional combined multiple 3D hyperspectral images into one 4D dataset. This data the detection of fluorescence that require multiple illumination settings.

Objective
 To compare the performance of common linear unlearning techniques applied to 4D and 3D HSI data configurations.

Materials and Methods
 Nerve and ligament samples were collected from bovine trotters and kept in normal saline throughout image acquisition. 4D Hyperspectral Imaging: Individual 3D hyperspectral images were acquired under different excitation wavelengths. Samples were illuminated with monochromatic light sources.



RESULTS
 The 4D-HSI dataset was analyzed using software analysis techniques. The software analysis techniques included the decomposition of dataset, and non-invasive blood and tissue based on acquired 4D-HSI datasets, and comparing to the 3D approach. The results of the software analysis techniques are presented in Figure 1. The results indicate that the 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of nerve and ligament differentiation.

CONCLUSIONS
 The results of this study indicate that 4D-HSI is a promising tool for nerve and ligament differentiation. The 4D-HSI dataset contains information that is not present in the 3D dataset. The 4D-HSI dataset is more informative than the 3D dataset. The 4D-HSI dataset is more suitable for the detection of nerve and ligament differentiation.

ACKNOWLEDGMENTS
 The authors thank the members of the Orbeli Institute of Physiology NAS RA for their support and assistance during the experiments. The authors also thank the members of the American University of Armenia for their support and assistance during the experiments.

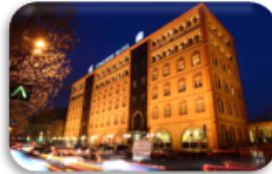
REFERENCES
 1. Chilingaryan, N., et al. "Pulsed field ablation in patients with persistent atrial fibrillation." *Journal of the American College of Cardiology* 70 (2018): 2069-2080.
 2. Soghomonian, T., et al. "Evaluation of pulsed field ablation lesion characteristics using an in vitro reproducible model." *Journal of Interventional Cardiac Electrophysiology* 2020: 1-8.



Solving Nature's Mysteries Using Advanced Bioimaging Approaches



4-6 November, 2024
Yerevan, Armenia



The 3-day conference will bring together researchers and professionals who utilize advanced imaging techniques to address a variety of biomedical questions and challenges. The program will include talks on cardiac imaging, neurophysiology, toxinology, computational approaches and emerging new technologies. The list of invited distinguished speakers includes, among others, Sandor Gyorke (Ohio State University, USA), Sergei Kazarian (Imperial College London), and Emilia Encheva (George Washington University, USA).

Jointly organized by the BIO-SEE society, funded by the Chan Zuckerberg Initiative, the ERA Chair project, funded by the European Union, and the Orbeli Institute of Physiology of the Armenian National Academy of Sciences, this international conference will feature invited talks, poster session, best image competition, roundtable discussions and social program.



Scan to register

Main Venue: Congress Hotel, Yerevan
Registration Deadline: August 12, 2024
Abstract Submission Deadline: October 1, 2024



Scan to submit abstract

Registered participants will have full access to conference meeting rooms, coffee breaks and lunches. A discounted hotel rate is available for those who register on time. Accepted abstracts will be included in the conference booklet with an assigned ISBN number.

Contacts for additional information:

For programmatic inquiries: Narine Sarvazyan, PhD, at phynas@gwu.edu

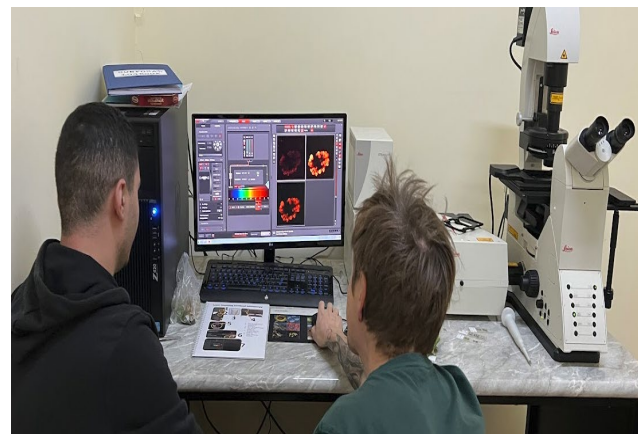
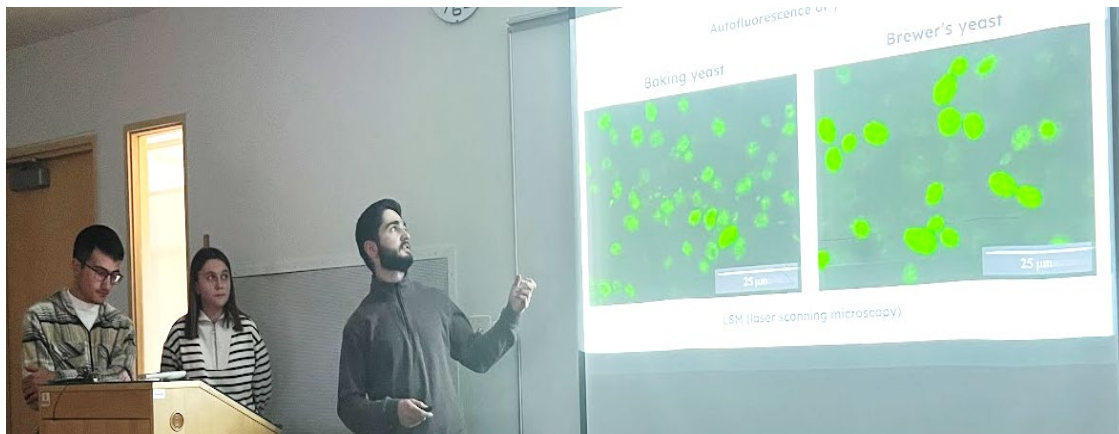
For organizational matters: Evelina Harutyunyan at evaharutyunyan@physiol.sci.am



Ongoing trainings and collaborative activities



Hands-on Courses in Advanced Bioimaging Techniques



EDUCATIONAL ACTIVITIES / OUTREACH

Science outreach activities for regional schools



2025: Vivarium renovation



Vivarium renovation – done!



Partners/Collaborators

Joint Projects and/or signed MoUs

- Katholeik University of Leuven, Belgium
- George Washington University, USA
- BGBM, Berlin, Germany (Freie University)
- University of Florence, Italy
- University of Granada, Spain
- Instituto de Biomedicina de Valencia, Spain
- Institute of Immunology, Zagreb, Croatia
- Instituto Butantan, Brazil
- Armenian Bone Marrow Donor Registry, RA
- University of Reading, UK
- Institute of Biophysics and Cell Engineering, Moldova



THE GEORGE
WASHINGTON
UNIVERSITY
WASHINGTON



KU LEUVEN



Armenian Bone Marrow
Donor Registry



SUBMITTED GRANTS

This proposal version was submitted by on Brussels Local Time. Issued by the Funding & Tenders Portal Submission System.

Application forms

Proposal ID **SEP-211076846**

Acronym **NPDT-for-AMEEV**

1 - General information

Fields marked * are mandatory to fill.

Topic	ERC-2024-ADG	Type of Action	HORIZON-ERC
Call	ERC-2024-ADG	Type of Model Grant Agreement	HORIZON-AG-LS

Acronym NPDT-for-AMEEV

Proposal title Development of drug-based, non-plasma-derived biological therapies for viper snakebite treatment in Africa, Middle East and Europe; in silico, in vitro and in vivo approaches



101201618 - NPDT-for-AMEEV



WT reference N320005/Z/24/Z

Draft (0) **Waiting for Wellcome decision (1)** Past (3)

1 application awaiting decision

Sorted by recently submitted

Received by Wellcome

Reference number: 320005/Z/24/Z

Discovery Award

Discovery of a universal snakebite antivenom based on 3D-AI-guided screening and design

Lead applicant: Naira Ayvazyan (you)

Application submitted: 3 December 2024

22-OCT-25

Acknowledgements



**Funded by
the European Union**



The RA Ministry of Education, Science, Culture and Sports

Higher Education and Science Committee