

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Medical Image & Signal Processing Research (MISP) Center

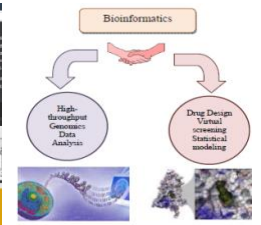
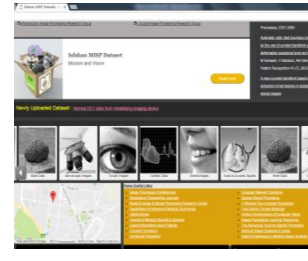
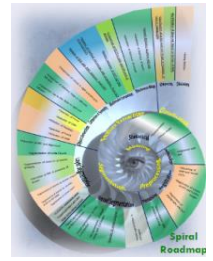
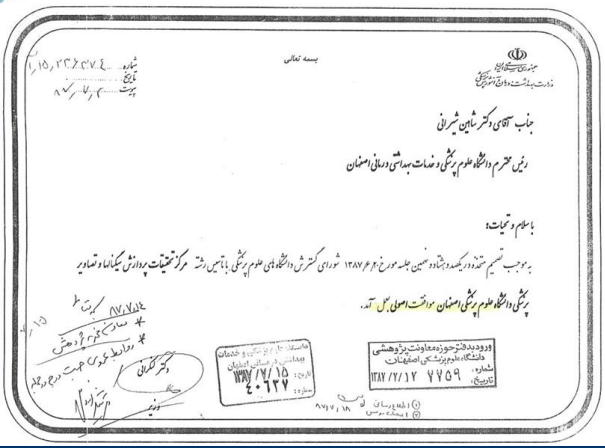
Isfahan University of Medical Sciences

<https://misp.mui.ac.ir>



MISP

- ❑ MISP founded in 2007
- ❑ In MISP, the faculty members of 3 important universities of Isfahan cooperate to reach the goals.
 - Isfahan University of Medical Sciences
 - Isfahan University
 - Isfahan University of Technology
- ❑ The focus is on medical signals and images processing





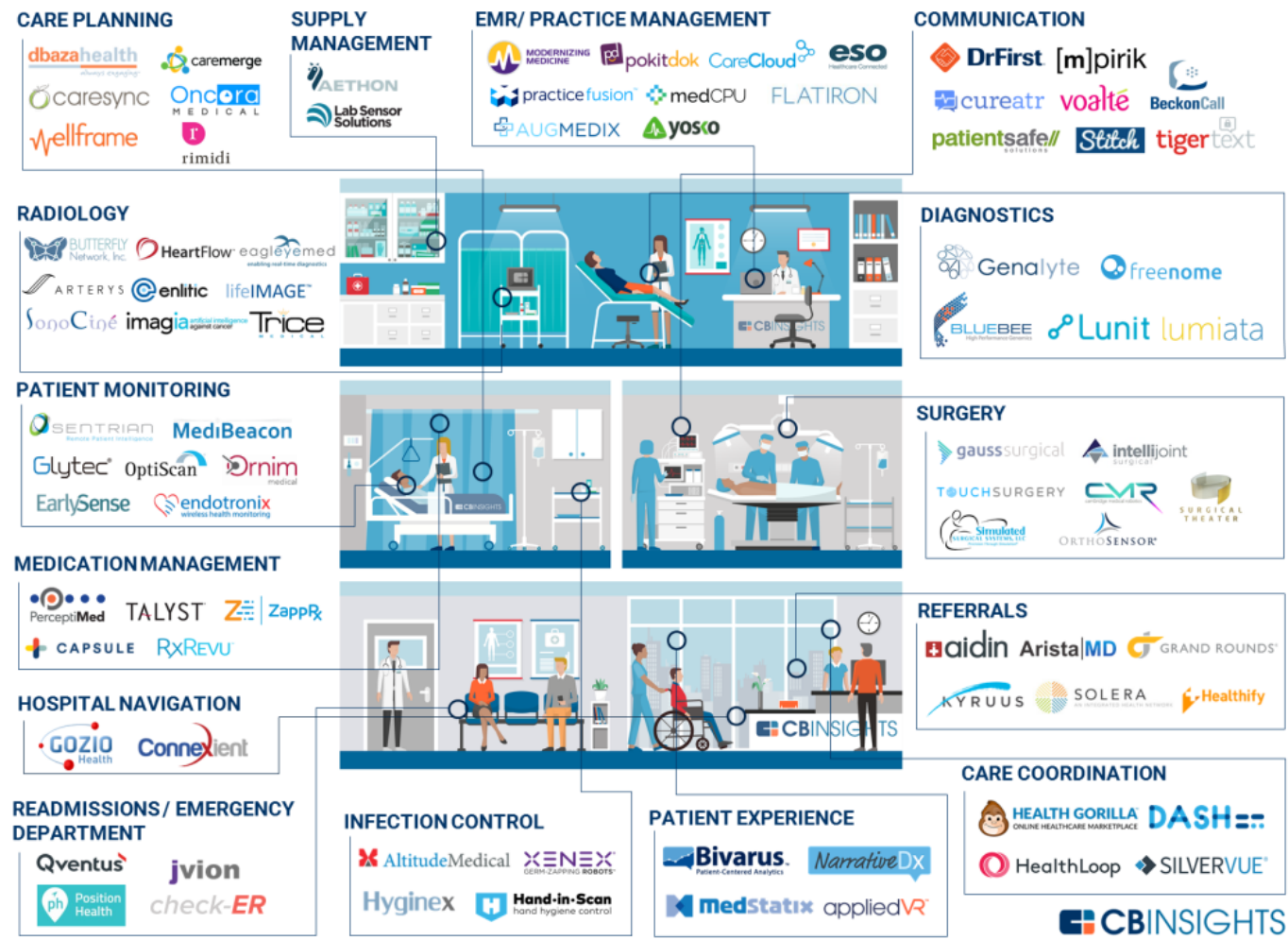
MISP Goals

- **To propose mathematical theories and computerized algorithms related to modelling and re-constructing signals and images**
- **To develop soft-wares for modelling signals and images**
- **To collect datasets from local patients**
- **To identify existing challenges and propose engineering solutions for them**



Smart Health

THE DIGITAL HOSPITAL: 82 COMPANIES REINVENTING THE PRACTICE OF MEDICINE



Hospital building/ facilities
(Smart lighting systems, CCTV, intelligent blood bank system, etc.)

Medical/ hospital tools and equipment
Connecting equipment to the information network (IoT), Remote patient monitoring (biosensors & IoT)

Patient services
(HIS, EMR, EHR)

Disease diagnosis/ treatment
Robotic surgery
Application of AI in data analysis, diagnosis and predictions, Personalized Medicine

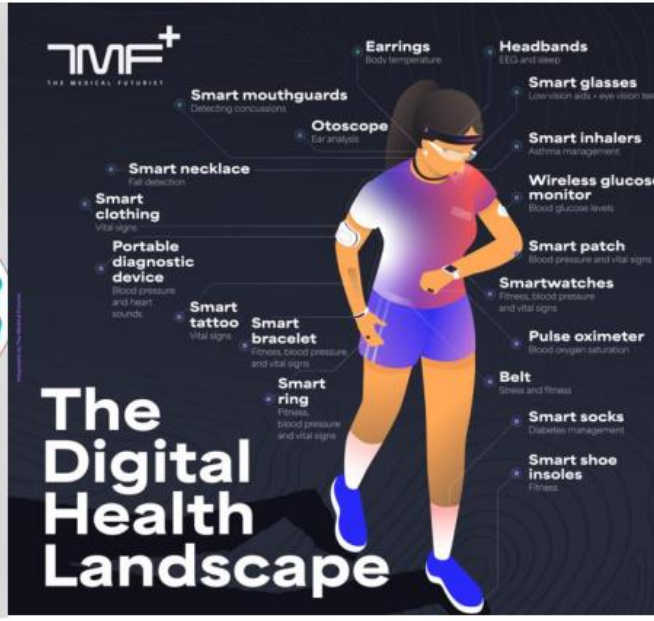
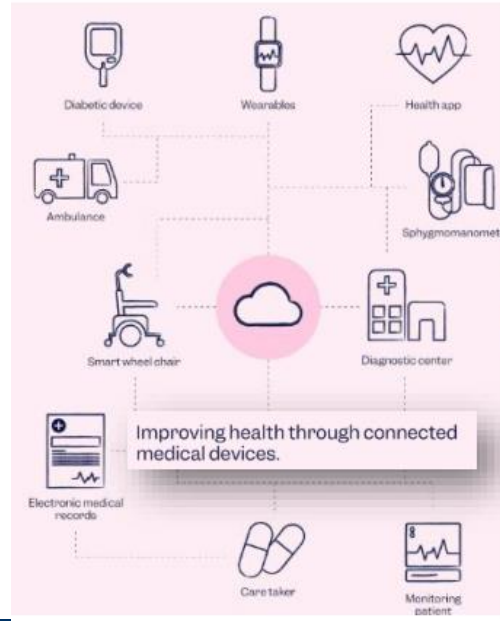
Why Smart Health is Important Today?



IoMT

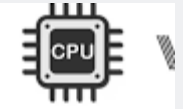
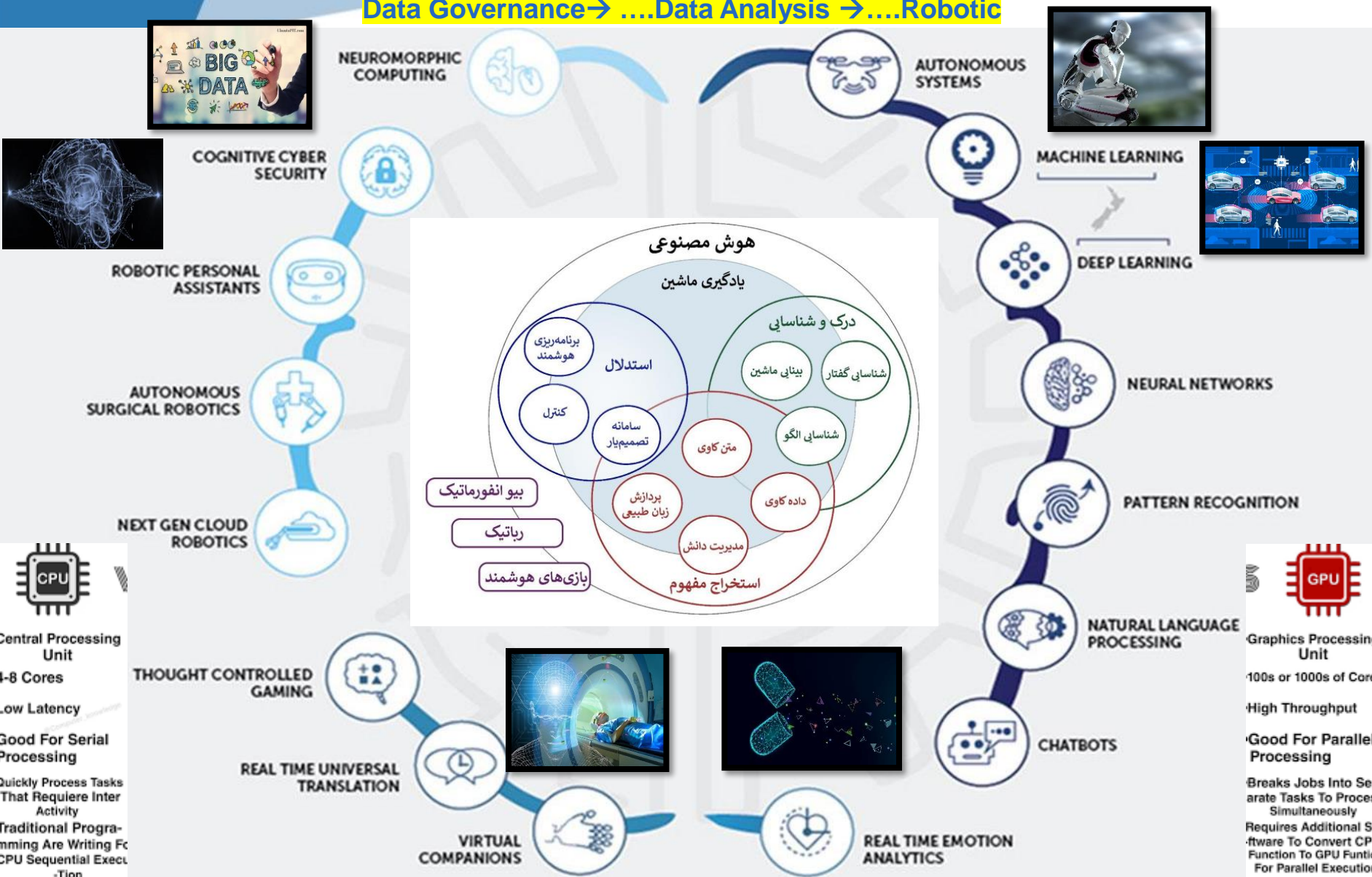
Telemedicine

Wearables

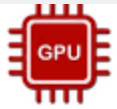


Artificial Intelligence

Data Governance → ...Data Analysis → ...Robotic



- Central Processing Unit
- 4-8 Cores
- Low Latency
- Good For Serial Processing
- Quickly Process Tasks That Requere Inter Activity
- Traditional Programming Are Writing Fc CPU Sequential Exec-Tion



- Graphics Processing Unit
- 100s or 1000s of Cores
- High Throughput
- Good For Parallel Processing
- Breaks Jobs Into Separate Tasks To Process Simultaneously
- Requires Additional Software To Convert CPU Function To GPU Funtion For Parallel Execution

پروژه های تحقیقاتی

جهت همکاری با مرکز تحقیقات پردازش

یک نسخه تکمیل شده از فرم متقاضیان

- پروژه های تحقیقاتی پیشنهادی
- فراخوان های فعال مرکز
- روند ارسال، تصویب و اتمام طرح
- طرح های تصویب شده در مرکز

طرح های پژوهشی :

تاکنون طرح های پژوهشی متعددی در شورای پژوهشی این مرکز به تصویب نهایی رسیده است و مقالات علمی حاصل از این چاپ رسیده است. همچنین چاپ کتاب و ثبت اختراع نیز حاصل برخی از این طرحها می باشد. برخی زمینه های مورد تحقیق که

۱- تهیه پایگاه داده های ایرانی ماموگرام به منظور استفاده در پردازش کامپیوتری ماموگرامها و ارزیابی کارایی الگوریتمهای ارتقا ک
۲- طراحی آلارم های گفتاری و بهبود وضعیت در سیستم وینتلاتور

۳- ارائه الگوریتمی به منظور شمارش سلول های رنگ شده توسط رنگ آمیزی ایمنوهیستوشیمی (IHC)

۴- تعیین عمق بیهوشی بیماران به کمک پردازش دیجیتالی سیگنال الکتروانسفالوگرام و مقایسه آن با اندیس BIS

۵- مروری بر روش های تفریق افتراقی ندول های ریوی مبتنی بر CAD با استفاده از پردازش دیجیتالی تصاویر CT ریوی

۶- پردازش تصاویر آنژیوگرافی بمنظور آشکارسازی عروق کرونوی قلب و اندازه گیری سرعت جریان خون

۷- طراحی یک سامانه رایانه ای جهت کمک به پزشکان در بازشناسایی اتوماتیک تومورهای سرطان سینه با استفاده از پردازش دی

۸- تشخیص ناهنجاری های سینه از طریق پردازش تصاویر حاصل از مادون قرمز Thermography

۹- طراحی و ساخت سیستم احضار پرستار در بخش ICU

۱۰- جداسازی و دسته بندی سلول های گردن رحم از طریق پردازش تصاویر حاصل از پاپ اسمیر برای تشخیص سلول های سالم

۱۱- اندازه گیری اتوماتیک زوایای بیم مهره ای و انحنای کمر از تصاویر دیجیتال رادیولوژی و مقایسه با روش دستی

۱۲- ارزیابی کامپیوتری میزان باروری مردان بر اساس ویژگی های حرکتی اسپرمها

۱۳- جبران ماتی تصاویر اولتراسوند با استفاده از الگوریتم تکراری گرادیان و بهبود کیفیت به وسیله پنجره تطبیقی و الگوریتم های

۱۴- مقایسه قابلیت نمایش اطلاعات در فیلم های رادیوگرافی آنالوگ و دیجیتال

۱۵- کاهش نویز سیگنال الکترومایوگرام با استفاده از فیلتر وقتی

۱۶- اندازه گیری و بررسی مشخصات امپدانس الکتریکی بافت زنده با استفاده از طیف نگاری امپدانس

۱۷- حذف اعوجاج تصاویر پری اپیکال در رادیولوژی دیجیتال دندان از طریق علامت گذاری تصویر

۱۸- طراحی و ساخت سیستم مینیاتوری بی سیم برای تحریک الکتریکی سیستم عصبی

۱۹- بررسی فعالیت الکتریکی مغز در تشخیص کلمات محدود فاسد به کمک P300 در ۲ حالت تکمیل به روش کامپیوتری و تلاش



دکتر علیرضا ورد (شورای پژوهشی)

رزومه



دکتر زهرا امینی (شورای پژوهشی)

رزومه



دکتر سعید کرمانی (شورای پژوهشی)

رزومه



دکتر راحله کافیه (شورای پژوهشی)

رزومه



دکتر امین مهنام (شورای پژوهشی)

رزومه



دکتر حمیدرضا مراتب (شورای پژوهشی)

رزومه



دکتر محمدرضا صحتی (شورای پژوهشی)

رزومه



دکتر علیرضا مهری دهنوی (شورای پژوهشی)

رزومه



دکتر محمد سعادت نیا (شورای پژوهشی)



دکتر مجید برکتین (شورای پژوهشی)

رزومه



دکتر فهیمه فاسمی (شورای پژوهشی)



دکتر مهناز اتحاد توکل (شورای پژوهشی)



دکتر ایمان ادیبی (شورای پژوهشی)



دکتر علیرضا پیمان (شورای پژوهشی)



دکتر علیرضا دهقانی (شورای پژوهشی)



دکتر پیمان ادیبی (شورای پژوهشی)



دکتر محمدرضا احمدزاده (شورای پژوهشی)



دکتر محمدرضا اخلاقی (شورای پژوهشی)



دکتر محمود سقایی (شورای پژوهشی)



دکتر اردشیر طالبی (شورای پژوهشی)



دکتر علیرضا کریمیان (شورای پژوهشی)

رزومه



دکتر محمدرضا یزدچی (شورای پژوهشی)

رزومه



دکتر حسین سعیدی (شورای پژوهشی)

رزومه



دکتر سعید صدری (شورای پژوهشی)



دکتر علی حسین نهبی (شورای پژوهشی)



دکتر فرزانه شایان (شورای پژوهشی)





Research Projects

- Till now, more than 100 research projects have been finalized
- To supervise more than 10 post-doc researchers
- To supervise more than 50 researchers in inter-disciplinary fields
- Cooperation with more than 30 faculty members of different universities
- To present more than 30 internship programs

Research Cores

<u>Scopy Image Analysis</u>	<u>Ocular Imaging</u>	<u>Biological Signal Processing</u>	<u>Bioinformatics</u>	<u>Microscopic Image Analysis</u>	<u>AI in Dentistry</u>	<u>Electronic in Medicine</u>
<u>Brain Data Analysis</u>	<u>Optics in Medicine</u>	<u>Mathematical Modeling</u>	<u>MIoT/ Personalized Medicine</u>	<u>Cardiac Signal/Image Analysis</u>	<u>Acoustic Signal Analysis</u>	<u>Tensor Analysis of Medical Data</u>

Performance of MISP



Medical Image and Signal Processing Research Center
Isfahan University of Medical Sciences

مرکز تحقیقات پردازش تصویر و سیگنال پزشکی
دانشگاه علوم پزشکی اصفهان



OFF نمایش آمار سال جاری




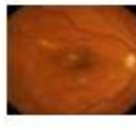




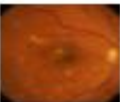




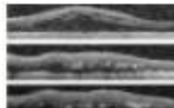


No.	Title	Authors	Journal	IF	SJR	CiteScore	Published	Cited By
1	Local comparison of cup to disc ratio in right and left eyes based on fusion of color fundus images and OCT B-scans Original Article	+ 2 more	Information Fusion 51:30-41	14.8 Q1	5.647 Q1	33.2 Q1	2019	16
2	Intra-retinal layer segmentation of 3D optical coherence tomography using coarse grained diffusion map Original Article	+ 2 more	Medical Image Analysis 17(8):907-928	10.7 Q1	4.112 Q1	22.1 Q1	2013	142
3	Adaptive rank selection for tensor ring decomposition Original Article	+ 2 more	IEEE Journal on Selected Topics in Signal Processing 15(3):454-463	8.7 Q1	3.818 Q1	19 Q1	2021	18
4	Macular OCT Classification Using a Multi-Scale Convolutional Neural Network Ensemble Original Article	+ 2 more	IEEE Transactions on Medical Imaging 37(4), pp. 1024-1034	8.9 Q1	3.703 Q1	21.8 Q1	2018	219
5	Attention to lesion: Lesion-Aware convolutional neural network for retinal optical coherence tomography image classification Original Article	+ 5 more	IEEE Transactions on Medical Imaging 38(8):1959-1970	8.9 Q1	3.703 Q1	21.8 Q1	2019	173
6	Three dimensional data-driven multi scale atomic representation of optical coherence tomography Original Article	+ 1 more	IEEE Transactions on Medical Imaging 34(5):1042-1062	8.9 Q1	3.703 Q1	21.8 Q1	2015	105
7	Statistical Modeling of Retinal Optical Coherence Tomography Original Article	+ 1 more	IEEE Transactions on Medical Imaging 35(6):1544-1554	8.9 Q1	3.703 Q1	21.8 Q1	2016	48
8	Multivariate Statistical Modeling of Retinal Optical Coherence Tomography Original Article	+ 1 more	IEEE Transactions on Medical Imaging 39(11):3475-3487	8.9 Q1	3.703 Q1	21.8 Q1	2020	19

Number of papers:343

Number of Citations:5523

H-index:39


Papers with international cooperation: 36%

 <p>Dataset for Fluorescein Angiography (Video & Late Image) in DME eyes The datasets (176 subjects) FA videos and late FA images in DICM eyes) and manual and automated markings used in the following paper can be downloaded from HERE.</p> <p>Read More</p>	 <p>OCT data & Color Fundus Images of Left & Right Eyes of 4+ healthy persons This dataset contains OCT data (in .img format) and color fundus data (in .jpg format) of left & right eyes of 4+ healthy persons.</p> <p>Read More</p>	 <p>Bone Marrow Microscopic Data (plasma cell (leukaemia) images) This folder contains bone marrow microscopic images. These images are categorized into two groups: Normal Plasma Cells and Myeloma Cells.</p> <p>Read More</p>	 <p>Fundus Fluorescein Angiogram Photographs of Diabetic Patients We have collected retinal image of 14 patients of different diabetic retinopathy stages including 14 normal data and 14 abnormal data in different stages.</p> <p>Read More</p>
 <p>Dataset of Leishmania Parasite in Microscopic Images 45 10-bit microscope microscopic images taken from bone marrow samples including leishman bodies.</p> <p>Read More</p>	 <p>CT & MR Volumes Used for Watermarking of DICOM Images This dataset contains 10 CT and 10 MR images in DICOM format.</p> <p>Read More</p>	 <p>Fundus Fluorescein Angiogram Photographs & Color Fundus Images of Diabetic Patients Publicly available database of both fundus fluorescein angiogram photographs and corresponding color fundus images of 14 healthy persons and 14 patients with diabetic retinopathy.</p> <p>Read More</p>	 <p>Database of corneal OCT taken from Heidelberg OCT imaging system (PD -mat data of 14 subjects) A set of 10 .mat corneal OCT images of 14 subjects. For each subject, it includes 10 .mat .mat files taken from Heidelberg OCT imaging system.</p> <p>Read More</p>
 <p>Colour Fundus Images of Healthy Persons & Patients with Diabetic Retinopathy This folder includes 14 colour fundus images of healthy persons and 14 colour fundus images of patients with diabetic retinopathy used for automatic curve-based detection of Foveal Avascular Zone (FAZ).</p> <p>Read More</p>	 <p>Database of FF retinal images for the purpose of vessel-based registration of Fundus and OCT projection images of retina A set of eye images consisting of 14 pairs of images (14 macular and 14 preapillan), from random patients, each pair acquired from eyes with a variety of retinal diseases.</p> <p>Read More</p>	 <p>Red blood cells A self-provided dataset contains 14 microscopic images of blood streams.</p> <p>Read More</p>	 <p>Kidney microscopic images (Glomeruli) A dataset for Glomeruli detection was collected with the contribution of MCR Research Center and Department of Pathology at IUMC</p> <p>Read More</p>
 <p>EEG Signals From Normal and MCI (Mild Cognitive Impairment) Cases This dataset is a collection of scalp EEG from 14 subjects (10 normal and 4 MCI) aged 18 to 74 with elementary or higher education and history of coronary angiography during recent year.</p> <p>Read More</p>	 <p>Dataset for OCT Classification (4+ Normal, FA, AMD & 4+ DME) This dataset is acquired at Moor Eye Hospital in Tehran and is consisting of 4+ normal, 4+ dry AMD, and 4+ DME OCTs.</p> <p>Read More</p>	 <p>OCT-based OCT of 14 healthy and 14 glaucoma data captured by Heidelberg Spectralis 14 healthy and 14 glaucoma data captured by Heidelberg Spectralis used to demonstrate the efficacy of a new imaging biomarker named Volumetric Cup-to-Disc Ratio (VCDR) for diagnosis of ocular diseases such as Glaucoma.</p> <p>Read More</p>	 <p>Cardiac MRI short-axis (CA) Cardiac MRI (CMR), the images of the left ventricular region were selected for all frames and their contrast was increased by windowing all slices are segmented interactively exactly based on the algorithm introduced by Helberg.</p> <p>Read More</p>

 <p>Vectorcardiography (VCG) The sampling rate was 441 Hz, and the samples were typically gathered for 10-second duration. The recorder device was Cardiac recorder. The 12-leads ECG and VCG signals were used in this study, each number in text file corresponds the leads except for all and avf.</p> <p>Read More</p>	 <p>Voice Samples of Patients with Internal Nasal Valve Collapse Before and After Functional Rhinoplasty This dataset contains voice samples of Patients with Internal Nasal Valve Collapse Before and After Functional Rhinoplasty. These voice samples are categorized into two groups: before and after functional rhinoplasty in patients with internal nasal valve collapse.</p> <p>Read More</p>	 <p>Voice Samples of Patients with Parkinson's disease (spontaneous swallows in Parkinson's disease) Data were collected from 14 subjects (14 males) who had Parkinson's disease (PD) (age = 64.1 ± 8.110 years). They were referred for video fluoroscopy swallow study (VFSS) assessment as part of their routine medical care.</p> <p>Read More</p>	 <p>FA and SLO Images of 14 subjects with diabetic retinopathy captured via Heidelberg Spectralis HRA/OCT device This dataset contains 14 pairs of FA and SLO images of 14 subjects with diabetic retinopathy in .jpg format are captured via Heidelberg Spectralis HRA/OCT device and used for automatic registration. FA images were captured with two different fields of view (14 and 40 degree).</p> <p>Read More</p>
 <p>Multichannel Intraluminal Impedance data belonging to 14 Individuals This dataset contains 14 episodes (14 minutes intervals) of Multichannel Intraluminal Impedance data belonging to 14 Individuals.</p> <p>The dataset includes three variables: "MPRINDEX", "S-OCF" and "PLAS_GSR" of the same size 14.</p> <p>Read More</p>	 <p>OCT Basal Data The data of this dataset was acquired from a Custom-made swept-source OCT (SS-OCT) imaging system designed and built in Dep. of Biomedical Engineering, University of Basel. The central wavelength, spectral bandwidth and A-scan rate of the custom-made SS-OCT are 1070 nm, 14 nm, and 14,000, respectively.</p> <p>Read More</p>	 <p>Topcon MD-OCT Diabetic Data for Denoising This dataset contains 14 MD OCT data using Topcon MD OCT-1000 imaging system in Ophthalmology Dept., Fazel Hospital, Isfahan, Iran. The datasets are in .mat format and are named "1" to "14". Subjects in the dataset were diagnosed to have retinal Pigment Epithelial Detachment (PED).</p> <p>Read More</p>	

Databases

Other Datasets

		
Fog Smear Images	Fundus Fluorescent Angiography Images	DATASET OF LEISHMANIA PARASITE IN MICROSCOPIC IMAGES
OCT data & Color Fundus Images of Left & Right Eyes of 4+ healthy persons	Malaria Images	Acute Myelogenous Leukemia (AML)
Database of FF retinal image; for the purpose of vessel-based registration of Fundus and OCT projection images of retina	Microscopic Images	Leukocytes (WBC) and Masks
CT Images	Breast thermography data	White Blood Cells (WBC)
MRI Images	wc.rar	Red Blood Cells (RBC)
Color Fundus Images	CMPP.rar	Dataset of corneal OCT taken from Heidelberg OCT imaging system (PD -mat data of 14 Subjects)
Angio-Fundus	Bone Marrow Microscopic Data	lba_crdet
Color Fundus Images with Doubles	plasma cell image images	colobation

A MATLAB package for automatic extraction of flow index in OCT-A images by intelligent vessel manipulation

SoftwareX 12 (2020) 100510



Contents lists available at ScienceDirect

SoftwareX

journal homepage: www.elsevier.com/locate/softx

Original software publication

A MATLAB package for automatic extraction of flow index in OCT-A images by intelligent vessel manipulation

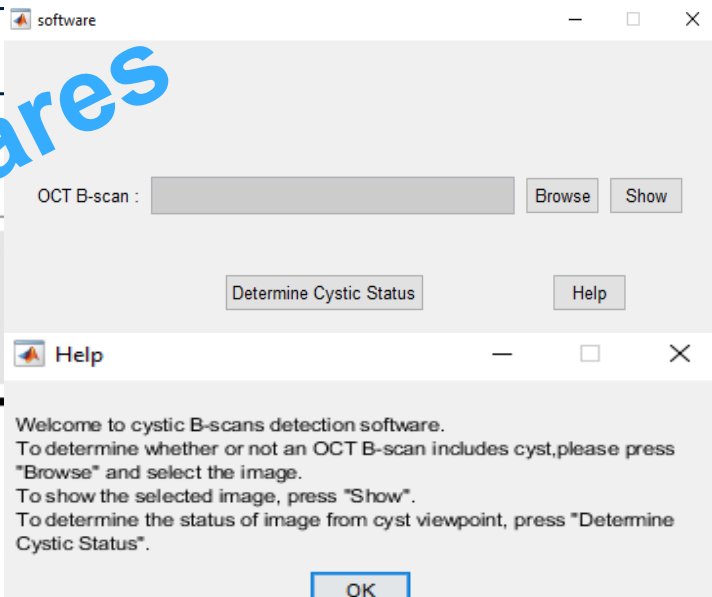
Sahar Hojati ^a, Rahele Kafieh ^{a,*}, Parisa Fardafshari ^b, Masoud Aghsaei Fard ^c

^a Medical Image and Signal Processing Research Center, School of Advanced Technologies in Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

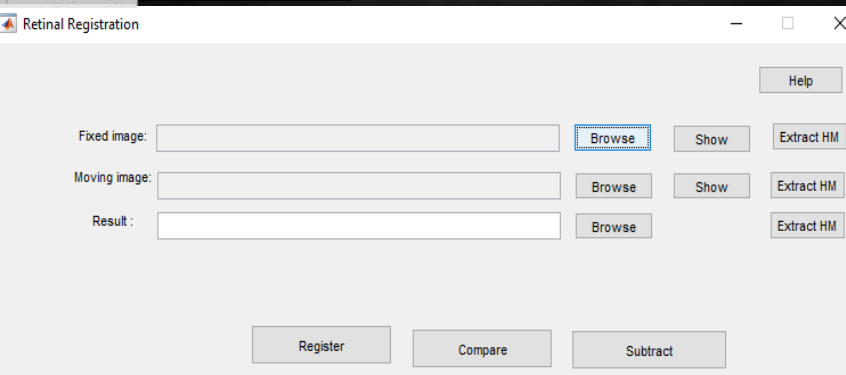
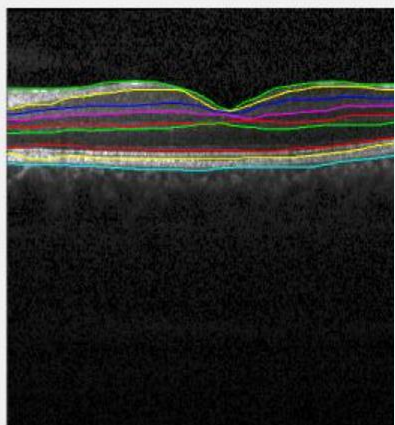
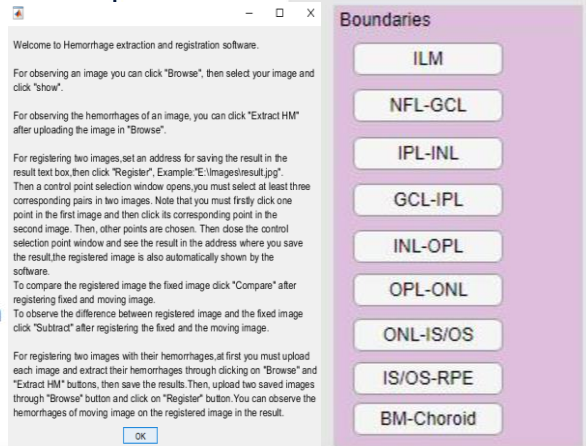
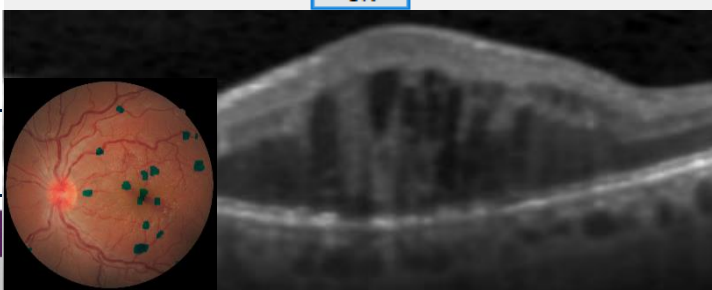
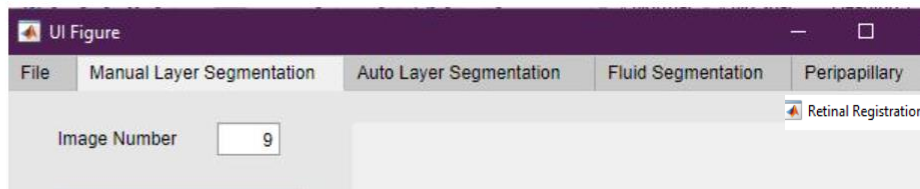
^b Student Research Committee, School of Advanced Technologies, Isfahan University of Medical Sciences, Isfahan, Iran

^c Farabi Eye Hospital, Tehran University of Medical sciences, Tehran, Iran

Softwares



A Semi-Automatic Software for Segmentation of Layers and Objects in Optical Coherence Tomography Images

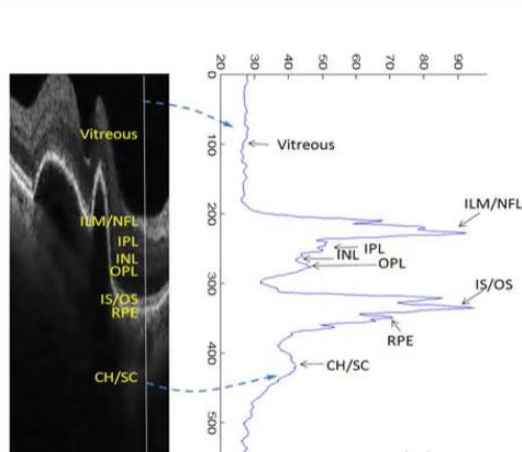


International Cooperations

OCT-let: Designing an Optimum Sparse Representation for Ophthalmic Optical Coherence Tomography Image Analysis



University of Gottingen
Germany



$$X(u, v) = \sum_{\gamma \in \Gamma} d_{\gamma} \varphi_{\gamma}(u, v), \quad \varphi_{\gamma} \in \mathcal{L}$$

Examples of Γ : frequency (Fourier), scale-translation (wavelets), scale-translation-frequency (wavelet packets), translation-duration-frequency (cosine packets), scale-translation-angle (geometrical X-lets, curvelets, bandlets, contourlets, wedgelets, etc).

Transform coefficients

Atoms: elementary functions (Basis, frame, tight frame)

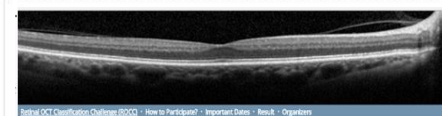
A feasibility study to develop an OCT-based ocular health kiosk to diagnose Diabetic Retinopathy



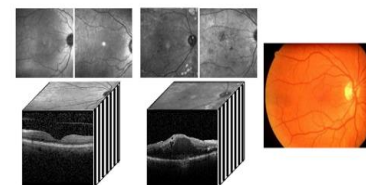
Iran-Switzerland Research Seed Money Grant

IEEE Signal Processing Society
6,562 followers
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The IEEE SPS VIP Cup gives students the opportunity to work together to solve real-life problems using video and image processing methods. Three final teams were selected to present their work and ...more



Retinal OCT Classification Challenge (ROCC)
Welcome to the Retinal OCT Classification Challenge (ROCC)
ROCC is organized as a one day Challenge in conjunction with MICCAI



Retinal diseases, such as age-related macular degeneration (AMD) or diabetic retinopathy (DR), are the major cause of blindness in a large percentage of world population. These pathologies currently affect over 87m of the world population and 157 million people worldwide, respectively. Retinal optical coherence tomography (OCT) imaging has become an indispensable diagnostic tool in Ophthalmology to early detect, treat and monitor these diseases. Automated retinal image analysis has the potential to improve the diagnostic process and make treatment monitoring more efficient. However, efficient leveraging key information for diagnosis is a complex task, as the retinal OCT images are corrupted by speckle noise, distorted with respect to the anatomy and the patient's movement in the acquisition process, and of a wide range of varying intensity. So, many traditional automated solutions and techniques do not suffice to accurately extract the required discriminative information. A variety of successful algorithms for computer-aided analysis of retinal OCT images are presented in the literature, but the robust use in clinical practice is still a major challenge for ongoing research in OCT image analysis. The goal of this challenge is to call different automated algorithms that are available to detect DR disease from normal retina on a common dataset of OCT volumes, acquired with Topcon 1000-OCT devices. We make available a dataset of OCT volumes containing Normal and DR cases with accompanying reference segmentation masks. The challenge is to design an automated algorithm that can accurately detect DR disease from normal retina on a common dataset of OCT volumes, acquired with Topcon 1000-OCT devices. We make available a dataset of OCT volumes containing Normal and DR cases with accompanying reference segmentation masks. The challenge is to design an automated algorithm that can accurately detect DR disease from normal retina on a common dataset of OCT volumes, acquired with Topcon 1000-OCT devices.

DATA LICENSE AGREEMENT
A1770691

This Data License Agreement ("Agreement") is entered into between Medical Image & Signal Processing Research Center ("MISP"), located at Isfahan University of Medical Sciences, Hezar-Jerib Avenue, Isfahan Province, Isfahan 81746 7346, Iran and International Business Machines Corporation ("IBM"), a New York corporation.

WHEREAS, MISP has certain retinal images and related data ("Data"); and

WHEREAS, IBM would like to license this Data from MISP, in a de-identified form in order to evaluate the analytical capabilities of certain IBM tools using data in the form and format available from MISP; and

WHEREAS, MISP is willing to license such Data to IBM, for purposes of conducting the evaluation in accordance with the terms and conditions set forth below;

NOW, THEREFORE, MISP and IBM agree as follows:

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Hossein Rabbani
Hossein Rabbani, PhD, SMIEEE
Director, MISP

Date: March 17, 2017

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MoUs

Collaboration Agreement

between

Charité - Universitätsmedizin Berlin
Charitéplatz 1, 10117 Berlin, Germany

represented by the Financial Director of the Faculty

- hereinafter called "Charité" -

organising institute:

NeuroCure Clinical Research Center
Clinical Neuroimmunology group
Charitéplatz 1, 10117 Berlin, Germany

- hereinafter called "Clinic/Institute" -

responsible project manager

Dr. Alexander U. Brandt

- hereinafter called "Project Manager" -

and

Medical Image and Signal Processing (MISP) Research Center
Isfahan University of Medical Sciences
Hezar Jarib St., central headquarter of Isfahan University of Medical Sciences, Isfahan
81746 73461, IRAN

represented by

Dr. Hossein Rabbani, Director of MISP Research Center

- hereinafter referred to as "MISP"

- collectively hereinafter referred to as the "Parties"

PREAMBLE

The Parties are engaged in research in the field of retinal image analysis. Charité possesses expertise and know-how in the field of optical coherence tomography and autoimmune neurologic disorders, and MISP possesses expertise and know-how in the field of retinal image analysis and deep learning.



MISP publications

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آشنایی با سرفصلهای دوره آموزشی هوش مصنوعی در چشم پزشکی



بسته اول: هوش مصنوعی در چشم پزشکی، پژوهش و مقاله خوانی مقدماتی A-EYE I

(مدت دوره ۸ جلسه یک ساعته)

زمان	عنوان مبحث
۱ ساعت	<p>۱- مقدمه‌ای به هوش مصنوعی در چشم پزشکی</p> <p>معرفی کلی دوره</p> <ul style="list-style-type: none"> • هوش مصنوعی چیست؟ • معرفی کلی هوش مصنوعی (Artificial Intelligence) و مفاهیم پایه • زیرشاخه‌های اصلی: یادگیری ماشین (Machine Learning)، یادگیری عمیق (Deep Learning)، و هوش مصنوعی نمادین (Symbolic AI) • کاربردهای مهم در پزشکی: از تشخیص بیماری تا درمان‌های فردمحور • چرا هوش مصنوعی در کانون توجهات قرار گرفت؟ • پیشرفت‌های اخیر در قدرت محاسباتی و داده‌های کلان (Big Data)

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