Contents

List of contribu	itors	Xiii
CHAPTER 1	Introduction to deep learning and diagnosis in medicine	1
	Abdulhalık Oğuz and Ömer Faruk Ertuğrul	
	Introduction	
	Deep learning architectures	
	Convolutional neural network	
	Recurrent neural network	
	Autoencoder	
	Generative adversarial network	
	Other architectures	
	Application fields of deep learning in medicine	
	Clinical and medical images	
	Biosignals	25
	Biomedicine	26
	Electronic health records	27
	Other fields	27
	Conclusions	28
	References	28
CHAPTER 2	One-dimensional convolutional neural network-based identification of sleep disorders using	
	electroencephalogram signals	41
	Muhammed Fatih Akıl and Ömer Faruk Ertuğrul	
	Introduction	41
	Materials and methods	44
	Dataset	44
	Method	47
	Results	50
	Discussions	53
	Conclusions	56
	References	57
CHAPTER 3	Classification of histopathological colon cancer images using particle swarm optimization-based feature	
	selection algorithm	61
	Md. Johir Raihan and Abdullah-Al Nahid	01
	Introduction	61
	Methodology	
	$\mathcal{O}_{\mathcal{I}}$	

	Dataset preparation	64
	Data preprocess and feature extraction	65
	Classifier	68
	Feature selection	69
	Performance metrics	70
	Results	71
	Classification results	72
	Models complexity comparison	
	SHAP analysis	
	Receiver operator characteristic analysis	
	Comparison	76
	Discussion	
	Conclusion	80
	References	
CHAPTER 4	Arrhythmia diagnosis from ECG signal pulses with	
	one-dimensional convolutional neural networks	83
	Umit Senturk, Kemal Polat, Ibrahim Yucedag and Fayadh Alenezi	
	Introduction	83
	Definition of problem	86
	Materials and methods	86
	Dataset	87
	Oversampling	88
	1D-CNN architecture	90
	Experimental result	
	Performance metrics	
	Experimental environment	
	Random forest classifier	
	1D-CNN VGG16 classifier results	
	Discussion	96
	Conclusion and future direction	
	References	
CHAPTER 5	Patch-based approaches to whole slide histologic grading of	f
	breast cancer using convolutional neural networks	103
	Sercan Çayır, Berkan Darbaz, Gizem Solmaz, Çisem Yazıcı,	
	Huseyin Kusetogulları, Fatma Tokat, Leonardo Obinna Iheme,	
	Engin Bozaba, Eren Tekin, Gülşah Özsoy, Samet Ayaltı,	
	Cavit Kerem Kayhan, Ümit İnce and Burak Uzel	
	Introduction and motivation	103
	Tubular formation	104

	Nuclear pleomorphism	105
	Mitotic figure detection and classification	105
	Challenges in obtaining Nottingham grading score	105
	Challenges in nuclear pleomorphism classification	105
	Challenges in detection/segmentation of tubular formation	106
	Challenges in mitotic classification	106
	Literature review and state of the art	106
	AI-based approaches for nuclear pleomorphism classification	107
	AI-based approaches for detection and segmentation of tubular formation	107
	AI-based approaches for mitotic classification and counting	108
	Problem/system/application definition	108
	Proposed methodology	109
	Pre-processing	109
	Deep learning methods	110
	Mitosis detection and classification	110
	Tubule segmentation	111
	Pleomorphism classification	112
	Results and discussions	112
	Dataset	112
	Assessment	113
	Qualitative assessment	114
	Conclusions	116
	Future work	116
	References	116
CHAPTER 6	Doon nouval architecture for breact concer detection	
CHAPIER O	Deep neural architecture for breast cancer detection	110
	from medical CT image modalities	. 119
	Samta Rani, Tanvir Ahmad and Sarfaraz Masood	110
	Introduction	
	Related work	
	Experimental work	
	Dataset	
	Work flow	
	Image pre-processing and augmentation methods	
	Models explored	
	Experimental results	
	Evaluation parameters	
	Models performance on BreakHis dataset	
	Models performance on BACH2018 dataset	
	Conclusion	
	References	133

CHAPTER 7	Automated analysis of phase-contrast optical microscopy time- lapse images: application to wound healing and cell motility assays of breast cancer		
	Yusuf Sait Erdem, Aydin Ayanzadeh, Berkay Mayalı, Muhammed Balı Özge Nur Belli, Mahmut Uçar, Özden Yalçın Özyusal, Devrim Pesen C Sevgi Önal, Kenan Morani, Leonardo Obinna Iheme, Behçet Uğur Tör and Devrim Ünay	kçi, Okvur,	
	Introduction and motivation		
	Literature review and state of the art	138	
	Pre-processing of PCM time-lapse images	138	
	Segmentation of PCM time-lapse images	138	
	Tracking and quantification from PCM time-lapse images	139	
	Workflows for the analysis of PCM time-lapse images	140	
	Problem definition, acquisition and annotation of data	140	
	Data acquisition	141	
	Data annotation	141	
	Proposed solution	141	
	Pre-processing	142	
	Segmentation	143	
	Tracking and quantification	143	
	Qualitative and quantitative analysis	144	
	Pre-processing	144	
	Segmentation	145	
	Tracking and quantification	148	
	Use cases and applications	149	
	Discussion	150	
	Conclusions	150	
	Outlook and future work	151	
	Software availability	151	
	Acknowledgment	151	
	References		
CHAPTER 8	Automatic detection of pathological changes in chest X-ray	155	
	screening images using deep learning methods	155	
	Vassili Kovalev, Ahmedkhan Radzhabov and Eduard Snezhko	155	
	Introduction		
	Screening for lung abnormalities		
	Introduction		
	Original image data		
	Image data preprocessing		
	Methods	159	

	Results	161
	Local conclusions	163
	Detecting extrapulmonary pathologies	163
	Introduction	163
	Data preparation	164
	Computational experiment	164
	Local conclusions	165
	Identification of subjects with lung roots abnormalities	166
	Introduction	166
	Materials	166
	Methods	168
	Results	168
	Local conclusions	168
	Chest X-ray image analysis web services	169
	Overview	169
	Authentication	169
	Authentication	171
	Input data validation	171
	Resources management	
	Applications for processing and analyzing chest X-ray	175
	Conclusion	176
	References	177
CHAPTER 9	Dependence of the results of adversarial attacks on medical	
	image modality, attack type, and defense methods	179
	Ihar Filipovich and Vassili Kovalev	2.,
	Introduction	179
	Materials	
	Chest X-ray images	
	CT images	
	Histopathology images	
	Methods	
	Attacks	183
	Defenses	186
	Experimental pipeline	187
	Results	187
	Experiments with X-ray images	187
	Experiments with computer tomography images	
	Experiments with histopathology images	
	Discussion	190
	The abilities of adversarial training defense method	190

	Important properties of class-label-guided denoiser defense	190
	Important properties of MagNet defense	191
	Conclusions	
	References	194
CHAPTER 10	A deep ensemble network for lung segmentation with stochastic weighted averaging	197
	R. Karthik, Makesh Srinivasan and K. Chandhru	
	Introduction	
	Related works	
	Proposed system	200
	Dataset collection	
	Data augmentation	200
	Segmentation architectures	
	Stochastic weighted averaging (SWA)	204
	Ensemble	205
	Results and discussion	205
	Dataset description	
	Ablation studies	206
	Performance analysis	208
	Conclusion	212
	References	212
CHAPTER 11	Deep ensembles and data augmentation for semantic segmentation	215
	Loris Nanni, Alessandra Lumini, Andrea Loreggia, Sheryl Brahnam	210
	and Daniela Cuza	215
	Introduction	
	Methods	
	Deep learning for semantic image segmentation	
	Loss functions	
	Dice Loss	
	Tversky Loss	
	Focal Tversky Loss	
	Focal Generalized Dice Loss	
	Log-Cosh Type Losses	
	SSIM Loss	
	Different functions combined loss	
	Data augmentation	
	Shadows	222

	Contrast and motion blur	
	Color mapping	
	Experimental results	
	Metrics	
	Datasets and testing protocol for polyp segmentation	
	Datasets and testing protocol for skin segmentation	
	Datasets and testing protocol for leukocyte segmentation	
	Experiments	
	Conclusions	
	Acknowledgment	
	References	232
CHAPTER 12	Classification of diseases from CT images using	
	LSTM-based CNN	235
	Shreyasi Roy Chowdhury, Yash Khare and Susmita Mazumdar	
	Introduction	
	Background	
	CT dataset-issues and challenges in handling them	
	Elucidating classical CNN- and LSTM-based CNN models	
	Convolutional neural network	
	LSTM networks	
	Previous work done on CNN-LSTM	
	Conclusion	
	References	246
CHAPTER 13	A novel polyp segmentation approach using U-net with	
	saliency-like feature fusion	251
	Şaban Öztürk and Kemal Polat	
	Introduction	
	Methodology	
	Image enhancement	
	Discriminatory feature matrices	
	Fusion of feature matrices	
	U-net fine-tuning	
	Loss function	
	Experiments and results	
	Datasets	
	Evaluation metrics	260
	Experimental results of enhanced images with image	<u>.</u>
	inpainting method	261

xii Contents

Experimental results of proposed method	263
Discussion	263
Conclusion	266
Compliance with ethical standards	267
Conflict of interest	
Human and animal rights	267
References	
Index	271