

Contents

1	BIOMEDICAL ENGINEERING EDUCATION IN POLAND - PIONEERS AND INSTITUTIONS	1
1.1	Introduction - beginnings	1
1.2	Development of medical engineering education fundamentals	2
1.3	Formation of multicentre knowledge-based education	8
1.4	Development of modern biomedical engineering education	15
1.5	Acknowledgment	24
	Bibliography	24
2	APPLICATION OF ENTROPY-BASED METHODS TO DISTINGUISH HEALTHY INDIVIDUALS WITH NORMAL SINUS RHYTHM FROM PATIENTS WITH CONGESTIVE HEART FAILURE	28
2.1	Abstract	28
2.2	Introduction	28
2.3	Data	29
2.4	Permutation Entropy	29
2.5	Block Entropy	30
2.6	Results	30
2.7	Conclusions	36
2.8	Acknowledgment	36
	Bibliography	36
3	THE ROLE OF INFERENCE IN MOBILE MEDICAL APPLICATION DESIGN	38
3.1	Introduction	38
3.2	Methods and materials	40
3.2.1	Data set	41
3.2.2	Model architecture	41
3.2.3	Inference	43
3.2.4	Mobile Application	43
3.3	Results	45
3.4	Discussion and Conclusions	46
3.5	Acknowledgment	47
	Bibliography	47

4	MACHINE LEARNING APPLICATIONS IN RECOGNIZING HUMAN EMOTIONS BASED ON THE EEG	49
4.1	Introduction	49
4.2	Electroencephalography and neural oscillations	50
4.3	Emotions model	51
4.4	EEG signals acquisition	53
4.5	Presentation of Datasets	55
4.6	Preprocessing, artefact removing, brainwaves	56
4.6.1	Target variable and feature extraction	68
4.7	Modeling	75
4.8	Results and analysis	77
4.9	Summary	80
4.10	Acknowledgment	81
	Bibliography	81
5	DETECTION OF BREATHING AND HEART RATE USING AN ECG SIGNAL MEASURED WHILE BATHING IN THE BATHTUB	87
5.1	Introduction	87
5.2	Materials and methods	90
5.2.1	System configuration	90
5.2.2	Processing	92
5.2.3	Measurement protocol	93
5.3	Results	94
5.4	Conclusion	99
	Bibliography	101
6	A MEASUREMENT SYSTEM FOR MONITORING CARDIOVASCULAR EVENTS IN SYNCOPE PATIENTS	103
6.1	Abstract	103
6.2	Introduction	104
6.3	Materials and methods	108
6.4	Results	111
6.5	Conclusion	113
	Bibliography	114
7	BIOLOGICAL AGE ASSESSMENT ALGORITHMS BASED ON X-RAY IMAGES OF BONE TISSUE	117
7.1	Introduction	117
7.2	An analysis of available databases and solutions	118
7.3	Experimental work	119
7.4	Results	122
7.5	Conclusions	125
	Bibliography	125
8	INVESTIGATION OF ENERGY DEPOSITION AND ITS OPTICAL IMAGING IN POLYMER GEL DOSIMETERS	128
8.1	Introduction	128

8.2	Studies of radiation-induced nanostructures in gel dosimeters . . .	131
8.3	Polymer gel dosimetry in radiotherapy quality assurance	133
8.4	Laser Computed Tomography and its clinical applications	133
8.5	Acknowledgment	136
	Bibliography	136
9	MONTE CARLO MODELING OF OPTICAL SENSOR FOR	
	POST-OPERATIVE FREE FLAP MONITORING	141
9.1	Abstract	141
9.2	List of acronyms	141
9.3	Introduction	142
9.4	Anatomy	142
9.5	Vessel positioning	143
9.6	Blood flow monitoring techniques	143
9.7	First optical window	145
9.8	Monte-Carlo simulation	146
9.8.1	Method	146
9.8.2	Simulation	148
9.9	Discussion	148
9.10	Conclusions	153
	Bibliography	153
	Index of authors	156