
Contents

Chapter 1	
Introduction to Teleradiology	1
SAJEESH KUMAR	
1.1 Introduction to Telemedicine	1
1.2 What Is Teleradiology.....	2
1.2.1 Acquisition of Images.....	2
1.2.2 Transfer of Images.....	2
1.2.3 Viewing of Images.....	3
1.3 Basic System Components	3
1.3.1 Image-Sending Station	3
1.3.1.1 Image Resolution.....	4
1.3.1.2 Compression	4
1.3.1.3 Transmission (Modem) Speed.....	4
1.3.2 Transmission Network	5
1.3.3 Receiving/Image-Review Station.....	5
1.3.3.1 Modem	5
1.3.3.2 Computer Hardware	5
1.3.3.3 Image-Enhancement Software.....	5
1.3.3.4 Monitors.....	6
1.4 Scope of Teleradiology	6
1.5 Relevance of Teleradiology in Developing Countries	7
1.6 Rewards of Teleradiology	8
Summary	8
References	9

Chapter 2

The Future of Teleradiology in Medicine Is Here Today ... 11BRAD C. HEARALY, DAVIS VIPRAKASIT,
and WILLIAM K. JOHNSTON III

2.1	Introduction.....	11
2.2	History: The Beginning	12
2.3	Future Goals and Benefits	13
2.4	Technical Framework: Backbone for Teleradiology .	13
2.5	Teleradiology Security and Preservation of Confidentiality: How Health Providers Maintain Confidentiality with the Electronic Transmission of Patient Records	17
2.6	Education and Training: Increasing the Knowledge of Physicians with Increased Image Exposure	17
2.7	Future Directions: Where Wireless Communications Could Take Teleradiology.....	18
2.8	Conclusion.....	19
	Summary	19
	References	20

Chapter 3

Compression of Medical Images for Teleradiology 21

RAJASVARAN LOGESWARAN

3.1	Background Information	21
3.2	Global Experience with Reversible Compression ...	23
3.3	Global Experience with Irreversible Compression ..	24
3.4	Education and Training: Benefits of Irreversible Compression and Modeling.....	26
3.5	Future Directions	28
3.6	Conclusion.....	29
	Summary	29
	References	30

Chapter 4**DICOM Image Secure Communication with
Internet Protocols..... 33**

JIANGUO ZHANG

4.1	Introduction.....	33
4.2	Image Communication Modes in Teleradiology	34
4.3	TCP/IPv6/IPv4 Communication Protocols and DICOM Communication Software	35
4.3.1	Basic Architecture of TCP/IP.....	35
4.3.2	DICOM Communication Software.....	37
4.4	Implementation of DICOM Secure Image Communication Protocols.....	38
4.4.1	DICOM Communication with IPSec-Based Security Supported	39
4.4.2	DICOM Image Communication with SSL/TLS-Based Security Supported	41
4.5	Performance Evaluation of DICOM Image Secure Communication Protocols.....	41
4.6	DICOM Image Secure Communication in Web Applications	44
4.7	Future Directions and Applications of DICOM Image Secure Communication	45
	Summary	46
	References	46

Chapter 5**Radiological Tele-immersion..... 49**

ZHUMING AI, BEI JIN, and MARY RASMUSSEN

5.1	Introduction.....	49
5.2	Tele-immersive Devices	50
5.2.1	Personal Augmented Reality Immersive System	50
5.2.2	C-Wall.....	52
5.2.3	Physician's Personal VR Display	53
5.2.4	ImmersaDesk.....	54
5.3	Volume Rendering	54

5.4	Visualization of Large-Scale Volumetric Data Using a Computer Cluster	55
5.5	Tele-immersive Collaboration.....	58
5.6	Implementation.....	61
5.7	Conclusions	62
	Summary	62
	Acknowledgments.....	63
	References	63

Chapter 6

**Use of a Radiology Picture Archiving and Communication
System to Catalogue Photographic Images.....** **65**

JAMES E. SILBERZWEIG and AZITA S. KHORSANDI

6.1	Introduction.....	65
6.2	Experience with Documenting Venous Insufficiency	66
6.3	Conclusion.....	69
	Summary	69
	References	69

Chapter 7

Teleradiology with DICOM E-mail..... **71**

PETER MILDENBERGER

7.1	Introduction.....	71
7.2	Technical Aspects	72
7.3	Experiences	73
7.4	Conclusion.....	74
	Summary	75
	References	75

Chapter 8**Teleradiology Multimedia Messaging Service
in the Provision of Emergency Neurosurgical Service 77**

WAI HOE NG, ERNEST WANG, and IVAN NG

8.1	Background	77
8.2	Global Experience	79
8.3	Multimedia Messaging Service	81
8.4	Conclusion	85
	Summary	86
	References	86

Chapter 9**Ultrasound Image Transmission via Camera Phones..... 89**

MICHAEL BLAIVAS

9.1	Introduction.....	89
9.2	Potential Uses.....	90
9.3	Challenges	93
9.4	Image Transmission	98
9.5	Conclusion	98
	Summary	99
	References	99

Chapter 10**Clinical Teleradiology: Collaboration over the Web
During Interventional Radiology Procedures..... 101**

LEFTERIS G. GORTZIS

10.1	Background Information	101
10.2	Global Experience	102
10.3	Collaboration Patterns and E-learning.....	106
10.3.1	E-learning in Synchronous Mode	106
10.3.2	E-learning in Asynchronous Mode.....	107
10.4	Future Directions	108
	Summary	111
	References	111

Chapter 11

Teleplanning in Image-Guided Dental Implantology 115

KURT SCHICHO and ROLF EWERS

11.1	Introduction.....	115
11.1.1	The Main Idea	115
11.1.2	The Augmented Reality Principle	116
11.1.3	Computer-Assisted Dental Implantology and Telecommunication.....	117
11.1.4	Perspective: Surgical Training by Means of a Telenavigation Client.....	118
	Summary	120
	References	120

Chapter 12

**Web-Based Medical System for Managing and Processing
Gynecological–Obstetrical–Radiological Data 121**GEORGE K. MATSOPoulos, PANTELIS A. ASVESTAS,
KOSTANTINOS K. DELIBASIS, NIKOLAOS A. MOURAVLIANSKY,
and VASSILIOS KOULOULIAS

12.1	Introduction.....	121
12.2	System Structure	123
12.2.1	General System Structure.....	123
12.2.2	System Architecture	124
12.2.3	System Functionality.....	128
12.2.3.1	Management of Patient Data	129
12.2.3.2	Image Processing and Viewing of Gynecological Data.....	130
12.2.3.3	Classification of Mammographic Images	131
12.2.3.4	Registration of Mammographic Images	132
12.2.4	System Security	134
12.3	Clinical Application of the System	134
12.4	Discussion	135
12.5	Conclusions	137
	Summary	137
	References	137

Chapter 13**Robotized Tele-echography..... 139**

FABIEN COURREGES, PIERRE VIEYRES, and GERARD POISSON

13.1	Introduction.....	139
13.2	Tele-echography Plant General Structure.....	140
13.3	System Requirements and Technical Solutions	142
13.3.1	Robot Design.....	142
13.3.2	Communication and Data Transmission	146
13.3.3	Human–Machine Interfaces.....	149
13.4	Clinical Results	150
13.5	Conclusions and Perspectives	152
	Summary	153
	References	153

Chapter 14**US Army Teleradiology: Using Modern X-ray****Technology To Treat Our Soldiers..... 155**DAVID M. LAM, KENNETH MEADE, RONALD POROPATICH,
RICANTHONY ASHLEY, and EDWARD C. CALLAWAY

14.1	Introduction.....	155
14.2	Overview of Current Military Radiology	159
14.3	Balkan Operations.....	162
14.4	Kosovo and the ERMC DIN-PACS.....	164
14.5	Afghanistan (Operation Enduring Freedom)	165
14.6	Iraq (Operation Iraqi Freedom)	167
14.7	System Description	170
14.8	Teleradiology in Military Humanitarian Assistance Operations.....	172
14.9	Lessons Learned and Issues Still To Be Resolved....	173
14.10	Summary/Discussion	176
14.11	The Future of Military Radiology	177
	Summary	177
	References	178

Chapter 15

Teleradiology for Traumatic Brain Injury Management 181

CORRADO IACCARINO, ARMANDO RAPANA,
CHRISTIAN COMPAGNONE, FERNANDA TAGLIAFERRI,
and FRANCO SERVADEI

15.1	Background Information	181
15.2	Global Experience	184
15.3	Education and Training	187
15.3.1	Glasgow Coma Scale Value	188
15.3.2	GH Versus NH	189
15.3.3	CT Evolution	192
15.4	Future Directions	195
	Summary	198
	References	198

Chapter 16

**Impact of Teleradiology in Clinical Practice:
A Malaysian Perspective 203**

B. J. J. ABDULLAH

16.1	Introduction	203
16.2	History of Teleradiology in Malaysia	205
16.3	Lessons Learned and Future Challenges	209
16.4	Conclusion	213
	Summary	213
	References	214

Chapter 17

Teleradiology: A Northern Finland Perspective 217

JARMO REPONEN

17.1	Teleradiology Background	217
17.2	Images Are Part of a Modern Electronic Patient Record	218
17.3	Electronic Multimedia Communication Between Primary and Secondary Care	219
17.4	Wireless Teleradiology	220
17.5	Education and Training	221
17.6	Current National Trends in Teleradiology	222

17.7	Future Directions	222
	Summary	223
	Acknowledgments.....	223
	References	223

Chapter 18

Wireless Teleradiology and Security	227
AYIS T. PYRROS and VAHID YAGHMAI	

18.1	Introduction.....	227
18.2	Overview of Wireless Teleradiology	227
18.3	Introduction to Wireless Networks.....	228
18.4	Wireless Ethernet Standards	229
18.5	Mobile Network Standards.....	230
18.6	Importance of Wireless Teleradiology	230
18.7	Applications of Wireless Teleradiology.....	230
18.8	Wireless Security Overview.....	232
18.9	Hacking the Network	233
18.10	Securing the Network.....	235
18.11	Secure the Access Point	236
18.12	Service Set Identifier.....	236
18.13	Media Access Control Lists	237
18.14	Encryption	237
18.15	Layered Security	239
18.16	Other Measures	239
18.17	Conclusions	240
	Summary	240
	References	240

Chapter 19

High-Volume Teleradiology Service: Focus on Radiologist and Patient Satisfaction.....	243
ELIZABETH A. KRUPINSKI	

19.1	Introduction.....	243
19.1.1	Factors that Contribute to Dissatisfaction of the Radiologists.....	245
19.1.2	Factors that Contribute to Improved Image Quality.	246
19.1.3	The Relation Between Softcopy Viewing of Images and Radiologist Fatigue	247
19.1.4	A Unique Telemammography Program	249

Summary	251
References	252

Chapter 20

**Global Trade in Teleradiology: Economic
and Legal Concerns** **253**

THOMAS R. MCLEAN and PATRICK B. MCLEAN

20.1 Introduction.....	253
20.2 Economic Issues	254
20.2.1 Ricardian Model	255
20.2.2 H-O Model.....	256
20.2.3 Implications	257
20.3 Legal Issues	258
20.3.1 Licensure Technicalities	258
20.3.2 Trade Barriers	259
20.3.3 Alternative Market Regulation.....	260
20.4 Conclusion.....	262
Summary	263
References	263

Chapter 21

Teleradiology: An Audit **265**

SAJEESH KUMAR

21.1 Teleradiology Is Advancing	265
21.2 Will Teleradiology Replace Traditional Methods?	265
21.3 Issues Related to Teleradiology: A Brief Overview	266
21.4 Changing Industry	266
21.5 Technical Challenge	267
21.6 Money Matters.....	267
21.7 Conclusion.....	268
Bibliography	269

Glossary **271**

Subject Index..... **283**