

Computers and Medicine

Bruce I. Blum, *Editor*

Computers and Medicine

Information Systems for Patient Care

Bruce I. Blum (Editor)

Computer-Assisted Medical Decision Making, Volume 1

James A. Reggia and Stanley Tuhim (Editors)

Computer-Assisted Medical Decision Making, Volume 2

James A. Reggia and Stanley Tuhim (Editors)

Expert Critiquing Systems

Perry L. Miller (Author)

Adoption, Diffusion, Utilization, and Impact of
Computers in Clinical Medicine

James G. Anderson and Stephen J. Jay

Perry L. Miller

Expert Critiquing Systems
Practice-Based Medical Consultation
by Computer

With 33 Illustrations



Springer-Verlag
New York Berlin Heidelberg Tokyo

Perry L. Miller, M.D., Ph.D.
Department of Anesthesiology
Yale University School of Medicine
New Haven, Connecticut 06510
U.S.A.

Series Editor

Bruce I. Blum
Applied Physics Laboratory
The Johns Hopkins University
Laurel, Maryland 20707
U.S.A.

Library of Congress Cataloging in Publication Data
Miller, Perry L.

Expert Critiquing Systems.
(Computers and Medicine)

Bibliography: p.

1. Medicine—Decision making—Data processing.
 2. Medical logic—Data processing.
 3. Expert systems (Computer science) I. Title. II. Series: Computers and medicine (New York, N.Y.) [DNLM: 1. Computers. 2. Patient Care Planning. W 26.5 M649e]
- R858.M543 1986 610'.28'5 85-31760

©1986 by Springer-Verlag New York Inc.
Softcover reprint of the hardcover 1st edition 1986

All rights reserved. No part of this book may be translated or reproduced in any form without written permission from Springer-Verlag, 175 Fifth Avenue, New York, New York 10010, U.S.A.

The use of general descriptive names, trade names, trademarks, etc. in this publication, even if the former are not especially identified, is not to be taken as a sign that such names, as understood by the Trade Marks and Merchandise Marks Act, may accordingly be used freely by anyone.

While the advice and information in this book are believed to be true and accurate at the date of going to press, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Typeset by Publishers Service, Bozeman, Montana.

9 8 7 6 5 4 3 2 1

ISBN-13:978-1-4613-8639-1 e-ISBN-13:978-1-4613-8637-7

DOI: 10.1007/978-1-4613-8637-7

Series Preface

Computer technology has impacted the practice of medicine in dramatic ways. Imaging techniques provide noninvasive tools which alter the diagnostic process. Sophisticated monitoring equipment presents new levels of detail for both patient management and research. In most of these technology applications, the computer is embedded in the device; its presence is transparent to the user.

There is also a growing number of applications in which the health care provider directly interacts with a computer. In many cases, these applications are limited to administrative functions, e.g., office practice management, location of hospital patients, appointments, and scheduling. Nevertheless, there also are instances of patient care functions such as results reporting, decision support, surveillance, and reminders.

This series, *Computers and Medicine*, will focus upon the direct use of information systems as it relates to the medical community. After twenty-five years of experimentation and experience, there are many tested applications which can be implemented economically using the current generation of computers. Moreover, the falling cost of computers suggests that there will be even more extensive use in the near future. Yet there is a gap between current practice and the state-of-the-art.

This lag in the diffusion of technology results from a combination of two factors. First, there are few sources designed to assist practitioners in learning what the new technology can do. Secondly, because the potential is not widely understood, there is a limited marketplace for some of the more advanced applications; this, in turn, limits commercial interest in the development of new products.

In the next decade, one can expect the field of medical information science to establish a better understanding of the role of computers in medicine. Furthermore, those entering the health care professions already will have had some formal training in computer science. For the near term, however, there is a clear need for books designed to illustrate how computers can assist in the practice of medicine. For without these collections, it will be very difficult for the practitioner to learn about a technology which certainly will alter his or her approach to medicine.

And that is the purpose of this series: the presentation of readings about the interaction of computers and medicine. The primary objectives are to describe the current state-of-the-art and to orient medical and health professionals and students with little or no experience with computer applications. We hope that this series will help in the rational transfer of computer technology to medical care.

Laurel, Maryland

BRUCE BLUM

Acknowledgments

This research was supported in part by NIH Grants LM03798 and R01 LM04336 from the National Library of Medicine, and was performed in part using the Rutgers AIM computer of the SUMEX computer network, supported by the NIH Division of Research Resources.

The author would like to thank a number of people who have helped in the projects described in this book. Particular acknowledgment is due Dr. Henry R. Black, who served as the domain expert for both the HT-ATTENDING and PHEO-ATTENDING systems, and to Steven J. Blumenfrucht, a Yale medical student, who implemented PHEO-ATTENDING.

The author would also like to thank Ms. Laurie Hauer for her help in preparing the initial manuscript.

Chapters 4, 5, 6, and 7 were adapted with permission from articles written by the author (P.L. Miller and Black 1984; P.L. Miller 1985a; P.L. Miller et al. 1984; and P.L. Miller 1985c respectively).

Contents

1. Expert Critiquing Systems	1
2. Artificial Intelligence in Medicine (AIM)	21
3. The ATTENDING System: Anesthesiology	29
4. HT-ATTENDING: Essential Hypertension	53
5. VQ-ATTENDING: Goal-Directed Critiquing of Ventilator Management	71
6. PHEO-ATTENDING: Pheochromocytoma Workup and Conflicting Expertise	91
7. ESSENTIAL-ATTENDING: Building Expert Critiquing Systems	105
8. ESSENTIAL-ATTENDING's Knowledge Exerciser Program	127
9. Lessons Learned: Design Parameters for a Critiquing System	133
10. Future Directions	147
Appendices	157
References	167
Index	171