Computer-Assisted Instruction and Diagnosis of Radiographic Findings†

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Recent advances in computer technology, including high bit-density storage, digital imaging, and the ability to interface microprocessors with videodisk, create enormous opportunities in the field of medical education. This program, utilizing a personal computer, videodisk, BASIC language, a linked text file system, and a triangulation approach to the interpretation of radiographs developed by Dr. W. L. Thompson, can enable the user to engage in a user-friendly, dynamic teaching program in radiology, applicable to various levels of expertise. Advantages include a relatively more compact and inexpensive system with rapid access and ease of revision which requires little instruction to the user.

Introduction

The application of computer technology in medicine is particularly evident in radiology. Abundant opportunities in imaging, diagnosis, and education arise with the advent of high bit-density media for data storage, analogue and digital imaging, and interfacing of microprocessors with videodisks. This burgeoning technology creates the need for similar advances in education. A shortcoming of medical education in the past has been to instruct with information, equipment, and methods no longer applicable to the current practice of medicine. If students are to be expected to function in an environment so reliant upon computers, it seems essential that they gain familiarity with them at some time in their medical education. This need not be a painful experience. Ideally, a teaching system would integrate a current data base applicable to a spectrum of users with various levels of expertise, and would be user-friendly and user-controlled.
MATERIALS AND METHODS

The program was created in BASIC language using an Apple II microprocessor with 64K RAM memory, a single disk drive, a videodisk, and an RS232 interface. Though the pilot program is designed for use with floppy disks, ultimately a hard disk, multiple terminals, and phone access will be integrated to yield a more efficient and versatile system. The videodisk has a capacity for storage of over 54,000 single frames and is capable of presenting both static and dynamic studies. Access time of an individual frame is less than 5 seconds.

A textfile system in which nondisplayed branching codes are integrated into each item of the textfile is utilized, providing branch logic and access to radiographs and help files. These help files will be discussed in more detail later. The "Main Menu" is presented as an example of the text file's basic structure. Its components are defined within parentheses, and the four-digit code, which is deleted in presentation to the user, is shown.

```
M001 (card number)
M001 Main Menu (heading)
M002 Skull/Brain (items)
M003 Head/Neck
M004 Spine
M005 Bone/Joints/Soft Tissue
M006 Cardiovascular
M007 Chest
M008 GI/Abdomen
M009 GU/Retroperitoneum
```

The four-digit code integrated into the heading identifies the preceding branch point, so that the user may easily return to the previous file for review. Simple manipulation of the string is done to delete all codes and to number the items (H = item number):

```
1100 SP$ = "":IF H<10 THEN SP$ = " 
1110 PRINT SP$;H;". ":RIGHTS (ITEM$(H),LEN (ITEM$(H))−4)
```

After input (X$) of a numbered selection, the code is used to proceed to the next textfile:

```
1360 R$ = LEFT$(ITEM$(VAL (X$)), 4)
```

In the case of GI/Abdomen, the code would thus be M008.

There are eight major groupings of Gamuts, A through H, which are the terminal branch files. In addition, there is another group of "M" files, as those listed above, which constitute the branch points. The letter heading plus a three-digit numeric code defines the particular file.

By utilizing this system, the user can proceed easily from an anatomic subdivision listed in the "Main Menu," as previously shown, to a specific radiographic finding. For