Title: SYSTEM AND METHOD FOR IDENTIFYING DATA ON A STORAGE MEDIUM

Abstract: The invention concerns a method (200) and system (100) for identifying a work to be stored on a storage medium. The invention includes the steps of: automatically selecting (212) at least one picture from the work; and verifying (214) that the selected picture contains a sufficient amount of information to be an identifier for the work. The invention can also include the steps of repeating (216) the automatically selecting and verifying steps until a suitable selected picture can be verified. The invention can also include the step of processing (218) the selected picture to create identifying data for the work. In one arrangement, the work can be an MPEG video segment containing at least one group of pictures (GOP) and the selected picture can be an intra picture from the GOP.
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SYSTEM AND METHOD FOR IDENTIFYING DATA ON A STORAGE MEDIUM

BACKGROUND OF THE INVENTION

1. Technical Field

The inventive arrangements relate generally to video recording systems and more particularly to video recording systems that record digitally encoded video sequences onto disc media such as recordable digital video discs, hard drives and magneto optical discs.

2. Description of Related Art

Many storage mediums that contain recorded data include one or more menus that can be used to enable a user to locate a specific portion of data on the storage medium. These menus can list the titles of each of the works stored on the disc along with a set of commands that enable the user to perform an operation, such as accessing the work identified by the title. In addition, each of the listed titles can contain a corresponding image representative of the work identified by the title.

For example, if the work is a video recording of a particular program, then a picture from the program can be positioned next to the title identifying such a recording. This picture is typically an MPEG intra picture that has been reduced to a thumbnail picture format. As such, the user can locate and access data recorded onto the storage medium by referring to a menu containing such thumbnail pictures.

In many instances, the selection of the picture to be placed next to its corresponding title is performed automatically. For example, if a DVD recorder is performing real-time recording, then the DVD recorder will automatically select a picture from the recording. Although convenient, such an automatic selection process has a significant disadvantage: if the picture selected is not indicative of the program that is being recorded, then the title/thumbnail combination in the menu
may be inadequate for purposes of identifying the desired recording. As an 
example, many programs include relatively short non-programming segments of 
video that contain blank pictures, picture transitions or effects between different 
scenes, titles or credits, often present at the beginning of the program. Although 
blank or nearly blank, these pictures are syntactically proper MPEG signals, and the 
DVD recorder has no way of recognizing that such pictures contain little or no 
theatric or programming content. Consequently, the automated selection of such 
programless images as an identifying thumbnail, fails to provide the user with a 
useful visual indicator to distinguish the recording beyond the title. Thus, what is 
needed is a way to select automatically a picture suitable for providing visual 
identification of a recorded work without increasing system complexity or cost.

SUMMARY OF THE INVENTION

The present invention concerns a method for identifying a work for storage on 
a storage medium. The method includes the steps of: automatically selecting at 
least one picture from the work; and verifying that the selected picture is suitable 
for use as an identifier of the work. In addition, the method can include the step of 
repeating the automatic selection and verifying steps until a suitable selected 
picture is verified. The method can also include the step of processing the selected 
picture to create identifying data for the work. In one arrangement, the processing 
step can include the step of placing the selected picture adjacent to a text-based 
title in a menu for the storage medium. Further, the processing step can include 
the step of converting the selected picture to a thumbnail picture format.

In one arrangement, the work can be an MPEG video segment containing at 
least one group of pictures (GOP), and the selected picture can be an intra picture 
from the GOP. In another arrangement, the step of automatically selecting a
picture from the work can include the steps of: locating a start code of the GOP; and counting a number of bytes from the GOP start code until an intra picture is detected. Alternatively, the step of automatically selecting a picture from the work can include the steps of: locating a picture start code in the MPEG video segment; examining an associated picture coding type parameter to determine whether a picture is an intra picture; and repeating the locating and the examining steps until an intra picture is detected. The step of verifying that the selected picture is suitable for use as an identifier for the work can include the steps of: counting a number of bytes in the detected intra picture; and comparing the number of bytes in the detected intra picture to a predetermined threshold. In one arrangement, the predetermined threshold can be based in part on a bit rate of the MPEG video segment.

The present invention also concerns a system for identifying a work for storage on a storage medium. The system includes: a receiver for receiving the work; and a video processor programmed to select automatically a picture from the work and verify that the selected picture is suitable for use as an identifier for the work. The system also includes suitable software and circuitry to implement the methods as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system that can identify a work for storage on a storage medium in accordance with the inventive arrangements.

FIG. 2 is a flow chart that illustrates an operation of identifying a work to be stored on a storage medium in accordance with the inventive arrangements.

DETAILED DESCRIPTION OF THE INVENTION
A device 100 for implementing the various advanced features in accordance with the inventive arrangements is shown in block diagram form in FIG. 1. The invention, however, is not limited to the particular system illustrated in FIG. 1, as the invention can be practiced with any other storage medium device capable of receiving a digitally encoded signal. In addition, the device 100 is not limited to reading data from or writing data to any particular type of storage medium, as any storage medium capable of storing digitally encoded data can be used with the device 100.

The system 100 can include a receiver 110, a searching engine 112, a microprocessor 114, processing circuitry 116 and a controller 118. Control and data interfaces can also be provided for permitting the microprocessor 114 to control the operation of the receiver 110, the searching engine 112, the processing circuitry 116 and the controller 118. Suitable software or firmware can be provided in memory for the conventional operations performed by the microprocessor 114. Further, program routines can be provided for the microprocessor 114 in accordance with the inventive arrangements. It should be understood that all or portions of the microprocessor 114, the searching engine 112 and the processing circuitry 116 can be considered a video processor 122 within contemplation of the present invention.

As shown in FIG. 1, the receiver 110 can receive a video signal. In one arrangement, the video signal can be an analog signal, and the receiver 110 can contain suitable circuitry for digitally encoding the video signal. Alternatively, the video signal can already be a digitally encoded signal. The video signal can then be sent to the searching engine 112. As will be explained in detail below, the searching engine 112 can select a potential picture from the video, which may be used for purposes of identifying the work being recorded onto the storage medium.
Once a potential picture in the incoming work is selected, the searching engine 112 can signal the microprocessor 114, which can verify that the potential picture is suitable for use as an identifier for the work. The processes employed by the invention to determine whether the selected picture is suitable as an identifier will be explained in the next section.

If the selected picture is not suitable, then the searching engine 112 can select another picture, and the microprocessor 114 can verify that the newly selected picture is appropriate for use as a work identifier. If the microprocessor 114 determines that a selected picture is sufficient, then the microprocessor 114 can signal the processing circuitry 116 to process the selected picture for purposes of creating identifying data, such as a menu, for the particular work being received. Examples of processing performed by the processing circuitry will be explained below. Once a work has been identified, the identifying data can be recorded onto a storage medium 120 through the controller 118. This identifying data can then be accessed at a later time.

Notably, the present invention can be realized in hardware, software, or a combination of hardware and software. Specifically, although the present invention as described herein contemplates the microprocessor 114 of FIG. 1, a typical combination of hardware and software could be a general purpose computer system with a computer program that, when being loaded and executed, controls the computer system and a recording system similar to that shown in FIG. 1 such that it carries out the methods described herein. The present invention can also be embedded in a computer program product which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods.
A computer program in the present context can mean any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: (a) conversion to another language, code or notation; and (b) reproduction in a different material form. The invention disclosed herein can be a method embedded in a computer program which can be implemented by a programmer using commercially available development tools for operating systems compatible with the microprocessor 114 described above.

IDENTIFYING DATA ON A STORAGE MEDIUM

According to the inventive arrangements, works for storage on a storage medium can be identified by automatically selecting at least one picture from the work and verifying that the selected picture is suitable for use as an identifier for the work. It should be understood that the term "work" can mean any segment of video. This process of automatically selecting at least one picture and verifying that the selected picture is suitable for use as an identifier can be repeated until a suitable selected picture is verified. Furthermore a user may manually select an image deemed visually suitable for verification by the process. Once a suitable picture is verified, the picture can be processed to create identifying data for the work.

Referring to flowchart 200 in FIG. 2, at step 210, a work for storage on a storage medium can be received. This work can be data that has previously been recorded onto a storage medium or can be a work that is currently being recorded, i.e., the invention can be used during both real and non-real time recording. In one arrangement, the work being received can be an MPEG video segment containing at least on group of pictures (GOP); however, the invention is not so limited, as the
work can be any other suitable digitally encoded signal. At step 212, at least one picture from the work can be automatically selected. As an example, if the work from which the picture is selected is an MPEG video signal containing at least one GOP, then a start code from the GOP can be located, and a number of bytes from the GOP start code can be counted until an intra picture is detected. In another example, a picture start code in the MPEG video signal can be located, and an associated picture coding type parameter can be examined to determine whether a particular picture is an intra picture. This process of locating picture start codes and examining the associated picture coding type parameter can continue until an intra picture is detected. It is understood, however, that the invention is not limited to these examples, as any other suitable process of automatically selecting at least one picture from the work can be used.

Referring to step 214, the selected picture can be verified to ensure that it is suitable for use as an identifier for the work. In one arrangement, the number of bytes contained in the selected picture can be counted and then compared to a predetermined threshold. As an example, if the selected picture is an intra picture, then the number of bytes in the intra picture can be compared to the predetermined threshold to determine whether the intra picture is suitable for use as an identifier for the work. The determination of suitability for use as a visual identifier derives from the fact that a well composed visual image will generally result in the generation of significantly more data than a blank picture or title roller caption.

In another arrangement, the predetermined threshold can be a predetermined number of bytes based on several variables such as the bit rate of the work and, if the work is MPEG video, the number of pictures in the GOP's. In
one particular algorithm, the average amount of data (D) contained in each intra
picture in the work based on the current bit rate of the work can be calculated.
Specifically, the bit rate can be divided by the fractional proportion of data
contained by the intra picture of a particular GOP as compared to the overall
amount of data in the GOP. In addition, the bit rate can be divided by the number
of GOP’s necessary to produce one second of video. Finally, the bit rate can be
divided by the number eight to convert the remaining amount of data to bytes. For
example, an intra picture typically contains one-sixth of the total data contained in
a GOP. Further, the number of pictures in a typical GOP equates to approximately
one-half second of video, and, therefore, it takes two GOP’s to produce one second
of video. Assuming a bit rate of approximately 4.5Mb/s, the average data rate D
can be determined as follows,

\[
D = \frac{4.5 \text{ Mb/s}}{6 \times 2 \times 8} = 47 \text{ Kbytes}
\]

Thus, the average intra picture in a video signal with a bit rate of roughly 4.5Mb/s
contains approximately 47 Kbytes of data and, for this example, if the selected
picture contains at least 47 Kbytes of data, then the selected picture can be used as
an identifier. In another arrangement, once the average data rate D is calculated, D
can be multiplied by a variable K where K can be any number greater than zero. For
instance, to increase the probability that the selected picture can be used as an
identifier, the value for K can be greater than one, as the predetermined threshold
would be greater than D. Alternatively, it may not be necessary to have such a high
threshold, and the value for K can be less than one thereby producing a
predetermined threshold less than D.

It should be understood that the verifying step is not limited to the example
of counting the number of bytes in an intra picture and comparing it to a
predetermined threshold, as other suitable techniques can be used. Moreover, the predetermined threshold is not limited to the foregoing examples, as the predetermined threshold can be calculated according to any other suitable procedure. Also, the invention is not limited to the particular numbers selected to explain how the predetermined threshold can be calculated, as it is understood that there are an infinite number of ways to calculate the predetermined threshold according to this particular formula.

Referring to step 216, if the number of bytes in the selected picture meets or exceeds the predetermined threshold, i.e., if the selected picture can be used as an identifier, then the process can continue at step 218. If the selected picture is deemed unsuitable for use as an identifier, then the process can continue at step 212 until a suitable selected picture is verified.

At step 218, if the selected picture can be used as an identifier, then the selected picture can be processed to create identifying data for the work. In one arrangement, the selected picture can be placed in a menu preferably next to a text-based title of the work. To facilitate such placement, the selected picture can also be converted to a thumbnail picture format. Finally, the process can end at step 220. Thus, the invention presents a way to select automatically a suitable picture for purposes of identifying a recorded work without increasing system complexity or costs.
Claims

1. A method for identifying a work for storage on a storage medium, comprising the steps of:
   automatically selecting at least one picture from the work; and
   verifying that the selected picture is suitable for use as an identifier for the work.

2. The method according to claim 1, further comprising the step of repeating said automatically selecting step and said verifying step until a suitable selected picture is verified.

3. The method according to claim 1, further comprising the step of processing the selected picture to create identifying data for the work.

4. The method according to claim 3, wherein said step of processing the selected picture to create identifying data for the work comprises the step of placing the selected picture adjacent to a text-based title in a menu for the storage medium.

5. The method according to claim 4, wherein said step of processing the selected picture to create identifying data for the work further comprises the step of converting the selected picture to a thumbnail picture format.
6. The method according to claim 1, wherein the work is an MPEG video segment containing at least one group of pictures (GOP) and the selected picture is an intra picture from the GOP.

7. The method according to claim 6, wherein said step of automatically selecting a picture from the work further comprises the step of:
   locating a start code of said intra picture from the GOP.

8. The method according to claim 7, wherein said step of verifying that the selected picture is suitable for use as an identifier for the work comprises the steps of:
   counting a number of bytes in the detected intra picture; and
   comparing the number of bytes in the detected intra picture to a predetermined threshold.

9. The method according to claim 8, wherein the predetermined threshold is based in part on a bit rate of the MPEG video segment.

10. The method according to claim 6, wherein said step of automatically selecting a picture from the work comprises the steps of:
    locating a picture start code in the MPEG video segment;
    examining an associated picture coding type parameter to determine whether a picture is an intra picture; and
    repeating said locating and said examining steps until an intra picture is detected.
11. The method according to claim 10, wherein said step of verifying that
the selected picture is suitable for use as an identifier for the work comprises the
steps of:
   counting a number of bytes in the detected intra picture; and
   comparing the number of bytes in the detected intra picture to a
   predetermined threshold.

12. The method according to claim 11, wherein the predetermined
threshold is based in part on a bit rate of the MPEG video segment.

13. A system for identifying a work for storage on a storage medium,
comprising:
   a receiver for receiving the work; and
   a video processor programmed to:
       automatically select a picture from the work; and
       verify that the selected picture is suitable for use as an identifier for
       the work.

14. The system according to claim 13, wherein the video processor is
further programmed to repeat automatic selection and verification until a suitable
selected picture is verified.

15. The method according to claim 13, wherein the video processor is
further programmed to process the selected picture to create identifying data for
the work.
16. The system according to claim 15, wherein the video processor is further programmed to process the selected picture to create identifying data for the work by placing the selected picture adjacent to a text-based title in a menu for the storage medium.

17. The system according to claim 16, wherein the video processor is further programmed to process the selected picture to create identifying data for the work by converting the selected picture to a thumbnail picture format.

18. The system according to claim 13, wherein the work is an MPEG video segment containing at least one group of pictures (GOP) and the selected picture is an intra picture from the GOP.

19. The system according to claim 18, wherein the video processor is further programmed to:

locate a start code of said intra picture from the GOP.

20. The system according to claim 19, wherein the video processor is further programmed to:

count a number of bytes in the detected intra picture; and

der determine the number of bytes in the detected intra picture to a predetermined threshold.
21. The system according to claim 20, wherein the predetermined threshold is based in part on a bit rate of the MPEG video segment.

22. The system according to claim 18, wherein the video processor is further programmed to:

locate a picture start code in the MPEG video segment;

examine an associated picture coding type parameter to determine whether a picture is an intra picture; and

repeat the locating and the examining steps until an intra picture is detected.

23. The system according to claim 22, wherein the video processor is further programmed to:

count a number of bytes in the detected intra picture; and

compare the number of bytes in the detected intra picture to a predetermined threshold.

24. The system according to claim 23, wherein the predetermined threshold is based in part on a bit rate of the MPEG video segment.
FIG. 2

200 Receive Work

210

212 Automatically Select at Least one Picture from Work

214 Verify Selected Picture is Suitable for use as Identifier for Work

216 Is Suitable Selected Picture Verified?

218 Process Selected Picture to Create Identifying Data for the Work

220 End
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

<table>
<thead>
<tr>
<th>IPC(7)</th>
<th>US CL</th>
</tr>
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<tbody>
<tr>
<td>G09G 5/00; H04N 7/08; 5/91, 5/93</td>
<td>345/642, 723; 348/473; 386/52, 55, 95</td>
</tr>
</tbody>
</table>

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S.: 345/642, 723; 348/473; 386/52, 55, 95

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 6,192,183 B1 (TANGUCHI et al) 20 February 2001 (20.02.01), figs. 6-8, cols. 1-2</td>
<td>1-5, 13-17</td>
</tr>
<tr>
<td>Y</td>
<td>US 5,657,433 A (MURASE et al.) 12 August 1997 (12.08.1997) Figs. 1-2 etc.</td>
<td>6-12, 18-24</td>
</tr>
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<td>A</td>
<td>US 5,532,833 A (HONG et al.) 02 July 1996, (02.07.1996), Figs. 1-5 etc.</td>
<td>1-24</td>
</tr>
<tr>
<td>A</td>
<td>US 5,289,276 A (SIRACUSE et al.) 22 February 1994 (22.02.1994), Figs.1-6 etc.</td>
<td>6-12, 18-24</td>
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</tbody>
</table>

* Further documents are listed in the continuation of Box C.  
* See patent family annex.

- **A** document defining the general state of the art which is not considered to be of particular relevance
- **E** earlier application or patent published on or after the international filing date
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- **X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- **&** document member of the same patent family

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