Make AVI movie files from BMP files on Microsloth Winders

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1 What is this?

I wanted a command line program which would assemble frame files into a movie file format. Specifically...

- Because the frames would be generated by another program, & I didn't want to wait for that program to generate all of them, the movie maker program needed to read the names of the frame files from standard input.
- The movie maker program needed the ability to delete each frame file after it had inserted the frame into the movie.
- I was unwilling to pay money for such a movie maker program.
- I wanted to learn more about movie files while I was at it.

So I wrote one & called it `avi-ar.exe`. This document contains the user manual for that program & for a related utility program. It also contains the source code for both programs.

Before writing my own program, I surveyed movie maker programs which were already available. I found few which were command line programs. None of those read the frame filenames from standard input. So I wrote my own, thereby achieving all of my requirements including "learn more about movie files".

2 License

One file, `getopt.c`, is in the public domain. I downloaded it from the TEX User's Group web site.

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3 Enumerate installed codecs

NAME bin/enum-icinfo.exe[1] – print a list of installed compressors

SYNOPSIS **enum-icinfo** `-h`

enum-icinfo `[-c`*char*`]`

DESCRIPTION bin/enum-icinfo.exe[2] prints to standard output a list of codecs installed on the computer. By default, the output format could be parsed by Common Lisp, but with the `-c` command line option, the output is in Delimeter Seperated Values (DSV) format.

Here is example output:

```
C:\temp>enum-icinfo

(ICINFO (n 0)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x64697663 "cvid")
```

[1] `enum-icinfo.exe`
[2] `enum-icinfo.exe`

```
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 1)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x30323469 "i420")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 2)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x31337669 "iv31")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 3)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x32337669 "iv32")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 4)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x31347669 "iv41")
        (dwFlags 0)
        (dwVersion . 0)
```

```
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 5)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x76757969 "iyuv")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 6)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x656C726D "mrle")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 7)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x6376736D "msvc")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 8)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x79767975 "uyvy")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
```

```
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 9)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x32797579 "yuy2")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 10)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x39757679 "yvu9")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "t"))

(ICINFO (n 11)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x75797679 "yvyu")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 12)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x3336326D "m263")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))
```

```
(ICINFO (n 13)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x3136326D "m261")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "m"))

(ICINFO (n 14)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x30357669 "iv50")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "i"))

(ICINFO (n 15)
        (dwSize . 568)
        (fccType #x63646976 "vidc")
        (fccHandler #x33766D77 "wmv3")
        (dwFlags 0)
        (dwVersion . 0)
        (dwVersionICM . 260)
        (szName . "")
        (szDescription . "")
        (szDriver . "w"))
```

OPTIONS `-c`*char* Tells `enum-icinfo` to print its output in DSV form with *char* as the delimeter. *char* must be a single printable character, such as a comma (`,`) or a colon (`:`). It is an error to omit *char*.

`-h` Print brief usage instructions.

INSTALLATION Copy bin/enum-icinfo.exe[3] into a directory that's in your path. Voilá! It's installed.!

AUTHOR Written by Gene Michael Stover.

BUGS Only available for Microsloth Winders.

[3] `enum-icinfo.exe`

Does not give the human-readable name for each codec. I had hoped that the Description field of the ICINFO structure would contain the human-readable name. ([9]) There is a list of codec Four-CC codes & their names at http://www.fourcc.org/codecs.php[4] .

SEE ALSO The executable, full documentation, & source code are available at http://cybertiggyr.com/gene/vwu/[5] .

`enum-icinfo` does most of its work with the Microsloth Winders ICInfo system call. ([8])

4 Create an AVI file from BMP files

NAME bin/avi-ar.exe[6] – create an AVI movie file from frames in separate files

SYNOPSIS **avi-ar** `-h`

avi-ar `[-E] [-c`*codec*`] [-f`*fps*`] [-q`*quality*`]` *avifile*

DESCRIPTION bin/avi-ar.exe[7] is a command line program which consumes frames from BMP files & produces an AVI movie file. Each BMP files contains one frame in the form of a Microsoft Windows's Device Independant Bitmap (DIB).

The resulting movie file does not have a sound track.

`avi-ar` has two modes of operation: *stdin* mode & *directory scan* mode.

In *stdin* mode, `avi-ar` reads the names of the frame files from standard intput. Each each line from standard input has one pathname. The pathnames may refer to any file, anywhere, except that they cannot contain newline characters. `avi-ar` will use *stdin* mode if you do *not* use the "-d" command line option.

In *directory scan* mode, `avi-ar` looks for frame files in the current directory. It assumes the frame files are in order (0, 1, 2, 3, ...). It assumes that each frame file's name is the frame number in decimal, with no leading zero, followed by "`.bmp`". In other words, the first frame's name is "`0.bmp`". The second is "`1.bmp`". The eleventh is "`10.bmp`". `avi-ar` will scan & read frame files until the next frame file does not exist *and* the *done file* does exist. It will delete the done file. `avi-ar` will be in *directory scan* mode if you use the "-d" command line option. The argument to the "-d" option is the name of the done file.

For example, if you use "-ddone.stop", then `avi-ar` will be in directory scan mode, & it will stop when there are no more frame files & there is a file called "`done.stop`".

[4] `fourcc.org`
[5] `http://cybertiggyr.com/gene/vwu/`
[6] `avi-ar.exe`
[7] `avi-ar.exe`

The reason `avi-ar` needs a *done* file is that it does not assume all the frame file exist before `avi-ar` starts. So it will scan the directory repeatedly, consuming frame files in order (0.bmp, 1.bmp, 2.bmp, ..., 10.bmp, 11.bmp, ...99.bmp, 100.bmp, ...) until the next expected frame file doesn't exist *and* the done file does exist. So you can start `avi-ar`, then start your frame-generating program.

The reason I created *directory scan* mode at all is that, on Microsloth Winders, the program I use to generate frames has difficulty running `avi-ar` in a way that the frame-generator can write the frame file names to `avi-ar`'s stdin. On unix-like systems, I rely on `stdin` mode.

OPTIONS `-E` Tells `avi-ar` to delete each frame file after writing the frame to the AVI file. *Use at your own risk.*

The `-E` is case-sensitive for your protection.

This option is for environments in which the frames are generated by another program, so no frame is sacred & it's safe to save space by removing them after writing them to the AVI file.

`-c`*`codec`* *Codec* is a four-character code which names a CODEC. Tells `avi-ar` to use *codec* for encoding the movie. Of course, the CODEC must be present on your comuter, & it must accept Device Independant Bitmaps as input. The default CODEC is "cvid" (which is Cinepak).

To get a list of CODECs on your computer, use `enum-icinfo.exe` 3.

`-d`*`donefile`* Tells `avi-ar` to use *directory scan* mode & specifies the name of the done file. By default, `avi-ar` uses *stdin* mode.

`-h` Print brief usage instructions.

`-f`*`fps`* Specifies that the movie file should be played at *fps* frames per second. Default is 24 fps.

`-q`*`quality`* Specifies the value for the `dwQuality` member of the AVICOMPRESSOPTIONS structure ([4]). The quality value q should be $0 < q \leq 10,000$. The default is 10,000.

ARGUMENTS **avifile** names the output file. This argument is required; there is no default.

INSTALLATION Copy bin/avi-ar.exe[8] into a directory that's in your path. Voilá! It's installed!

AUTHOR Written by Gene Michael Stover.

BUGS Only available for Microsloth Winders.

SEE ALSO The executable, full documentation, & source code are available at http://cybertiggyr.com/gene/vwu/[9] .

[8] `avi-ar.exe`

[9] `http://cybertiggyr.com/gene/vwu/`

5 Source Code & Executables

If you just want the executables, download them from the links in the `bin` directory, below.

If you want the source code so you can compile it yourself, create a subdirectory tree like the one below & download all of the files into it.

After downloading all of the source code files & creating the directories (even the ones which are empty before you compile), you can build all of the programs from the command line by CDing into the same directory with `Makefile.w32` & then running `build.bat`.

You will probably have to edit the pathname in `build.bat` for your system.

- bin/
  - bin/avi-ar.exe[10]
  - bin/bitmap.exe[11]
  - bin/choose-compressor.exe[12]
  - bin/enum-icinfo.exe[13]
  - bin/test0000.exe[14]
- build.bat[15]
- lib/
- Makefile.w32[16]
- src/
  - src/avi-ar.c[17]
  - src/bitmap.c[18]
  - src/bzero.c[19]
  - src/bzero.h[20]
  - src/cfg.c[21]
  - src/cfg.h[22]

[10] `avi-ar.exe`
[11] `bitmap.exe`
[12] `choose-compressor.exe`
[13] `enum-icinfo.exe`
[14] `test0000.exe`
[15] `build.bat`
[16] `Makefile.w32`
[17] `avi-ar.c`
[18] `bitmap.c`
[19] `bzero.c`
[20] `bzero.h`
[21] `cfg.c`
[22] `cfg.h`

  - src/choose-compressor.c[23]
  - src/enum-icinfo.c[24]
  - src/frame.c[25]
  - src/frame.h[26]
  - src/getopt.c[27]
  - src/gwp.c[28]
  - src/gwp.h[29]
  - src/log.c[30]
  - src/log.h[31]
  - src/msgmap.c[32]
  - src/msgmap.h[33]
  - src/test0000.c[34]
  - src/this.h[35]
  - src/types.h[36]
  - src/vidf.c[37]
  - src/vidf.h[38]
  - src/xmalloc.c[39]
  - src/xmalloc.h[40]

- tmp/

A Some AVI documentation

These are links to some of the documentation I used while writing `avi-ar.exe`.

[23] `choose-compressor.c`
[24] `enum-icinfo.c`
[25] `frame.c`
[26] `frame.h`
[27] `getopt.c`
[28] `gwp.c`
[29] `gwp.h`
[30] `log.c`
[31] `log.h`
[32] `msgmap.c`
[33] `msgmap.h`
[34] `test0000.c`
[35] `this.h`
[36] `types.h`
[37] `vidf.c`
[38] `vidf.h`
[39] `xmalloc.c`
[40] `xmalloc.h`

- Audio Video Interleave[41] at Wikipedia
- Windows Multimedia Start Page at MSDN [11]
- Multimedia Reference at MSDN
- "AVI example code for creating AVI files". By Lucian Wischik. [12]
- "AVI Video File Formats: Resolution, Pixels, Colors and Compression". By Douglas Dixon. 1999 May. [1]

  Radius Cinepak for portability?
- Windows Multimedia start page as MSDN.
- "AVI Overview". By John F. McGowan, Ph.D. [3]
- MPEG Software Simulation Group[42]
- Using AVI

  1. `ICCompressorChoose` ([6]) let's you choose a compressor from a dialog box. You can spcify the type of data to compress. I'll specify the input format's type with `pvIn`. I don't yet know what values specify what types unless it's "`DIB`", a Device-Independant Bitmap. Does this get us an initialized compressor or a structure to use to initialize a compressor?
  2. Open AVI File. `AVIFileCreateStream` ([5])
  3. `ICSeqCompressFrameStart` & its two related functions to compress frames. [10]
  4. http://www.openexr.com/[43]
     (a) http://www.openexr.com/TechnicalIntroduction.pdf[44]
     (b) http://www.openexr.com/ReadingAndWritingImageFiles.pdf[45]
     (c) http://www.openexr.com/openexrfilelayout.pdf[46]
     (d) http://www.openexr.com/OpenEXRColorManagement.pdf[47]
  5. `ICCompressorFree` [7]

[41] `http://en.wikipedia.org/wiki/AVI`
[42] —http://www.mpeg.org/MPEG/MSSG/—
[43] `Open EXR`
[44] `Technical Introduction`
[45] `Reading & Writing Image Files`
[46] `OpenEXR File Layout`
[47] `OpenEXR Color Management`

References

[1] Douglas Dixon. Avi video file formats: Resolution, pixels, colors and compression. *Manifest Technology*, May 1999. `http://tinyurl.com/24866t6`.

[2] GNU. *Gnu Lesser General Public License*, 2007. —http://www.gnu.org/copyleft/lgpl—.

[3] Ph.D. John F. McGowan. Avi overview. —http://www.jmcgowan.com/avi.html—, 1996.

[4] Microsoft. *AVICOMPRESSOPTIONS structure*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd756791(v=vs.85).aspx—.

[5] Microsoft. *AVIFileCreateStream function*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd756793

[6] Microsoft. *ICCompressorChoose function*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd742967(v=vs.85).aspx—.

[7] Microsoft. *ICCompressorFree function*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd742968

[8] Microsoft. *ICInfo function*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd743161

[9] Microsoft. *ICINFO structure*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd743162

[10] Microsoft. *ICSeqCompressFrameStart function*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd756969

[11] Microsoft. *Windows Multimedia*. —http://msdn.microsoft.com/en-us/library/windows/desktop/dd743883

[12] Lucian Wischik. Avi example code for creating avi files. http://tinyurl.com/2eobp2, 2002.