Everything You Wanted to Know About Closed Captioning

PixelTools

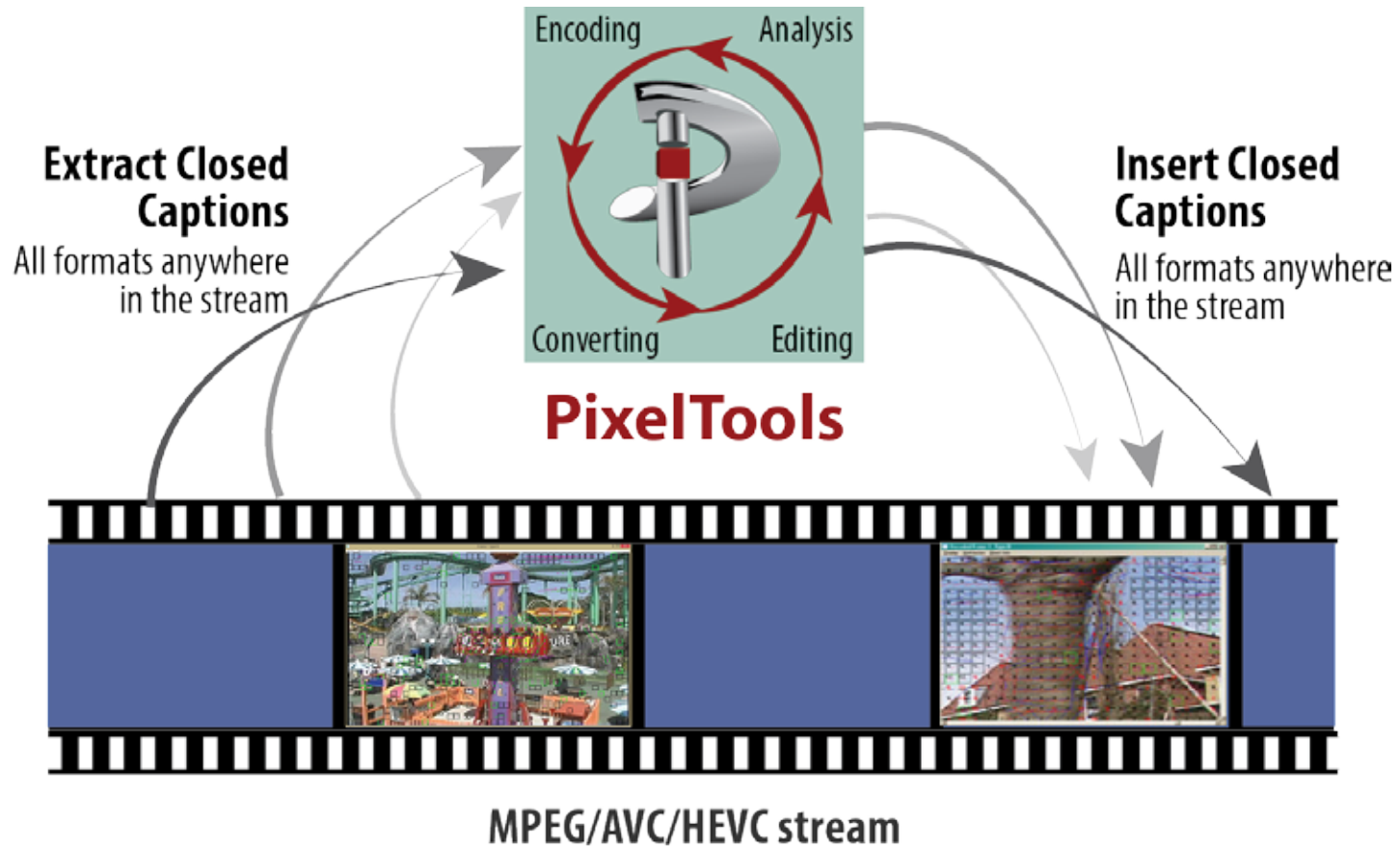PixelTools

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Closed captions are key players in video accessibility. With the massive proliferation of video content, it's become more important to make video accessible. Without captioning, the 360 million people (about 5% of the population) with hearing loss around the world would be unable to comprehend and engage with your video content.

Person talking | Video display of person talking | Speech extracted from video | Speech displayed on video screen as text
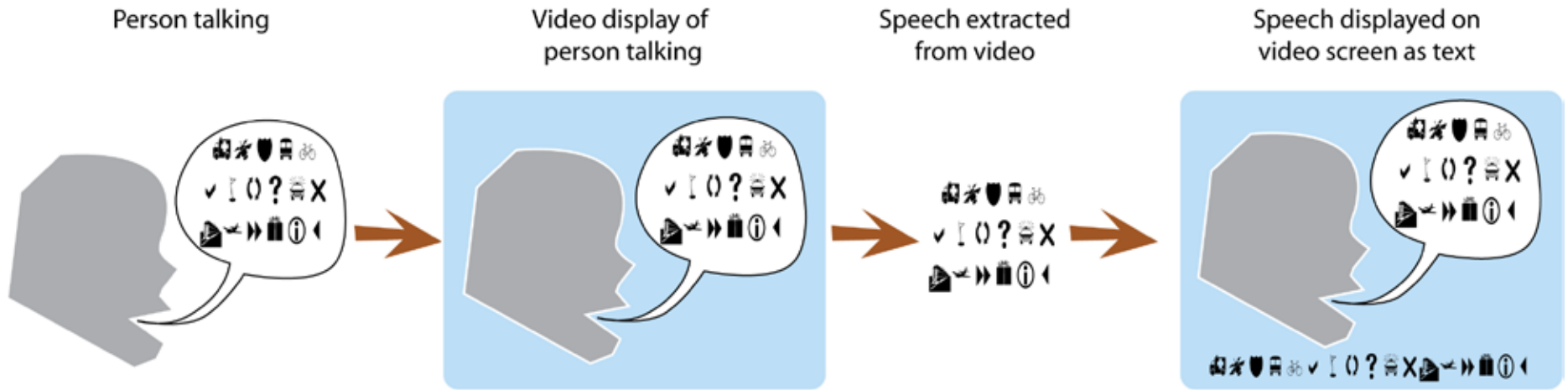
Creating and displaying closed captions

PixelTools

1   What is Closed Captioning?

Closed Captioning is text displayed onscreen that represents the spoken words and sounds in video content such as a movie or TV show. Initially, Closed Captioning was designed for the hard of hearing. Closed Captions have found utility for viewing video in environments that are not conducive to audio such as gyms, bars, schools, and libraries. Another important use of captions has become translations of speech into other languages. Closed Captioning can be utilized for device control (such as lowering a projection screen and dimming lights) and company specific data transmission.

Regulatory agencies in the United States and other countries have been requiring caption insertion in an increasingly number of broadcast situations including broadcasting over the Internet and closed college educational broadcasts.

Closed Captions can be turned on and off by the viewer usually via TV or Set top remote control. Open Captions are permanently embedded into the video content and cannot be disabled. The word Subtitles can mean Closed or Open Captions. Subtitles are often used to indicate Open Captions used for viewing foreign language movies. The DVD specification defines DVD subtitles as Closed Captions generated from a bitmap (picture) rather from closed captioning rendering hardware embedded in the TV or set top..

Closed Captioning is inserted into or associated with the video in a wide variety of formats. Currently the most popular formats are the old CEA-608 for Standard Definition broadcasts and more modern CEA-708 for High Definition broadcasts. The CEA-708 captions can (and usually do) include CEA-608 captions for backward compatibility.

CEA-608 captions were designed to be supported by a relatively simple decoder circuit in the user's TV. The 608 captions are displayed in a limited number of fixed locations in the display. CEA-708 captions take advantage of increase bandwidth and captioning decoder processing power. The captions can utilize different fonts. Their size can be changed via user controls.
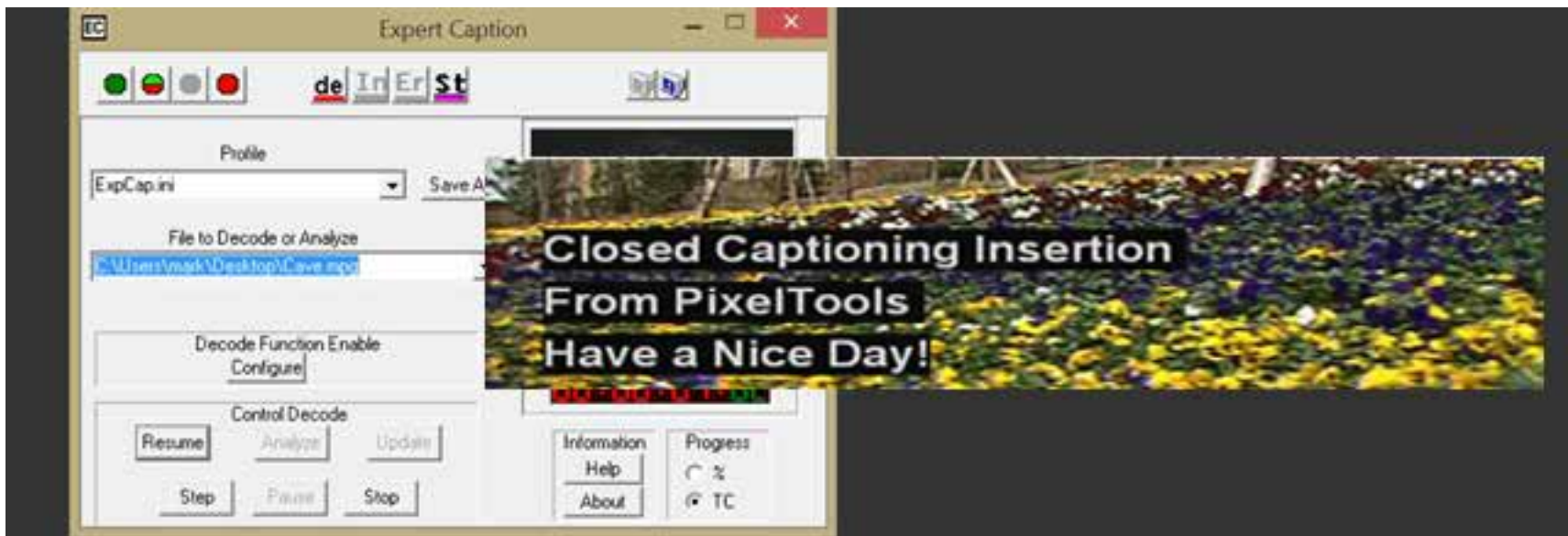
2   How to add closed captions to a movie or video

STEP 1 - The first step in adding closed captions is to transcribe the speech into written text and associated time code at which the text occurs.

This can be done manually by typing the movie speech into a text file on a computer or with the aide of software tools that range from $40,000 US to free. This text can be of a variety of formats including .txt, .scc, .mci, .srt.

STEP 2 - Combine the transcribed captioning with the associated video.

PixelTools and other companies supply software tools for embedding or multiplexing the captions into the video at the appropriate time code. PixelTools products can embed the transcribed captions in the video during encoding or can embed the captions into an existing video file without transcoding.
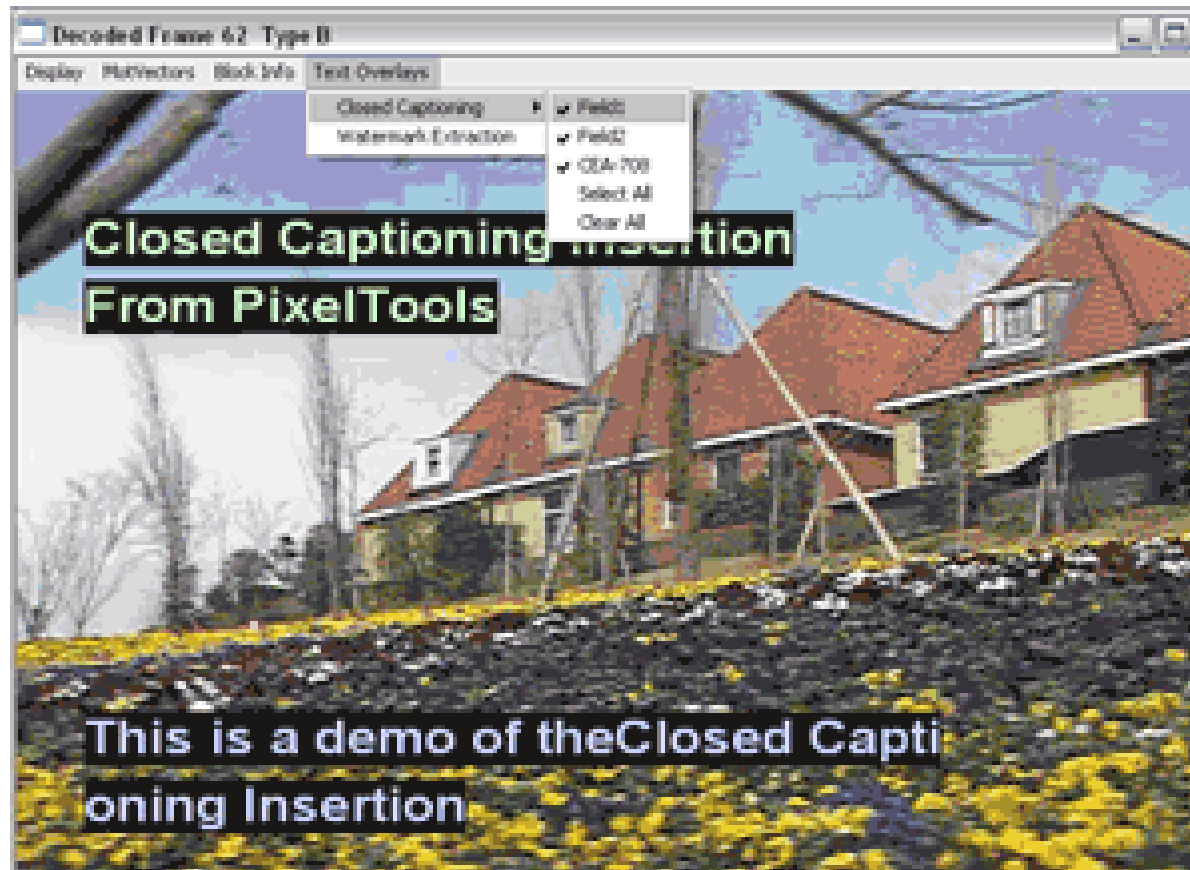
3 Closed Captioning Video Formats

Two popular types of closed captioning for broadcasting that are embedded in video:

CEA-608

This format, developed in 1970, defines two 7 bit binary characters per video field. These characters contain the text to be overlain and control characters that define how the text is to be displayed. The two caption characters, along with a synchronization signal, were included in analog TV line 21 which, unless the TV is way out of alignment is not displayed. A simple closed caption controller is included in analog TVs that synchronizes the captioning signal, picks out the control characters and displays the text as specified if the user has enabled the closed captioning.

In more detail -

The captions can be defined to be one of up to 32 characters in one of 15 rows on the TV with seven colors and normal, italic, and underlined fonts.

Each field can have a main and an alternate caption channel thus supporting 4 captioning streams (CC1 – CC4) in one video.

The control characters specify which one of the three display modes will be used:
1. Roll Up: Each new line of text causes the previous line to be displayed one line above. Two to four lines can be displayed at once.
2. Pop On: Each new line is stored in a non-displayed buffer. The Flip control command causes the text in the non-displayed buffer to be displayed.
3. Paint On: Each text character is displayed as it is extracted from the stream.

CEA-708

This specification was released in 1997 and is currently the most popular closed captioning format. It defines closed captioning for HDTV displays and provides much greater flexibility than CEA-608 at the expense of greater bandwidth. TV displays of any size and aspect can be supported. The CEA-708 specification includes the backward compatible CEA-608 characters.

In more detail:

CEA-708 can define multiple simultaneous text windows of any size in any location on the HDTV display. The user can dynamically increase or decrease the font and window size using their remote control.

The text characters can be 24-bit Unicode characters to support script languages such as Mandarin, Hebrew, or Persian.

The captioning bytes of text and control are packetized and embedded in the elementary video's user data. The specification allows for flexible aspect ratios and supports up to eight simultaneously displayed text windows. Each text window can include 15 lines of 31 characters per line. The text font size and spacing can be specified. The CEA-708 specification defines support for the backward compatible two bytes of CEA-608 data per frame. The specification defines 63 service channels each of which can have a different language. In addition to turning the 708 captions On and Off, the user can increase or decrease the caption size.

4   Closed Caption Transcription Formats

In the first part of the captioning process, the spoken words of the video are transcribed into text and time code. The captioning author can define the displayed text location, color, display mode, etc.   This information can be stored in a variety of transcription format.

Scenarist Closed Captioning (.scc)
This text file contains time codes followed by the actual CEA-608 hex code/ byte pairs that will be inserted in the frames at and following the time code. The 7 bit data and control codes include odd parity which makes them not trivial to interpret. CEA-708 captioning data can be generated indirectly from the .scc codes.

Text captions (.txt)
This text file containing time codes and the associated spoken text can be used in some captioning systems. A time code with no captions should remove the currently displayed captions. No information of the display captioning location, format, or type are included with this simple format.

MacCaption Closed Captioning (.mcc)
This text file consists of time codes for each frame followed by captioning codes representing the CEA-608/708 codes for each frame. The captioning codes are Run Length Encoded (RLE) to save characters in the .mcc file and are not readily interpretable. The file format was published in 2012 by CPC Corporation (now part of Telestream).

.srt
This text file consists of a pair of starting and ending time codes followed by the line(s) of text to be displayed in those time codes. No information on where the text is to be displayed on the user's monitor or the captioning font or format are included.

Web Video Text Tracks (WebVTT) (.vtt)
This text file is a modern version of the .srt format.

.cap
This binary file includes text, formatting, and time code. There are at least two different (incompatible) versions of this file.

.ddl (Decode Decision List)
.edl (Encode Decision List)
This text file contains time code (or frame number) followed by commands (such as ClosedCaption) The caption line of text after the ClosedCaption is inserted at the time code. This format was published by PixelTools in 1994 to support dynamic encoding and decoding processing.

5 Embedding Closed Caption Transcription into Video

PixelTools products can insert captioning into an existing encoded video file or into the file during encoding. Encoded video file formats include MPEG, AVC and HEVC. Analog Captioning refers to the NTSC line 21 caption pulses that are added to one of the lines (often line # 28) in the digital video.

	Expert Caption	Expert Broadcast	ExpertHD	MPEGRepairHD	Expert Workshop SDK
Add 708,608,SCTE20, SCTE21,ATSC Captioning During Encoding		✓	✓	✓	✓
Add 708,608,SCTE20, SCTE21,ATSC Captioning To Exiting stream	✓			✓	✓
Analyze Captioning	✓			✓	✓
Extract Captioning stream to .SCC or .TXT	✓			✓	✓
Print out contents of user_data	✓			✓	✓
Transcode Analog to Digital Captioning without re-encoding	✓			✓	✓
Add Analog Captioning		✓	✓	✓	✓
Transcode between CC formats	✓		✓	✓	✓
Automate using Batch mode	✓	✓	✓	✓	✓
Add Open Captioning during encoding			✓	✓	✓
Convert Analog Captioning to Open Captioning			✓	✓	✓

PixelTools

Caption Insertion into Existing Encoded Video

Expert-Caption and MPEGRepairHD can rapidly embed captioning into an existing MPEG or AVC stream using Drag and Drop, GUI, or Batch methods.

Drag and Drop

To use the Drag and Drop mode of ExpertCaption (or MPEGRepairHD), your MPEG or AVC file must have a .MPG extension and must be in the same directory as the .SCC file that contains your transcribed captions. The .SCC file must have the same name as the .MPG file and must have time codes that correspond to the MPEG video timecodes.

Launch Expert-Caption by dragging just the .MPG file onto the unlaunched Expert-Caption or MPEGRepairHD icon. That's all there is to it.

GUI

Launch Expert-Caption, drag or browse your uncaptioned MPG file in the File to Decode or Analyze edit box, and depress the Update button. Your transcribed caption file must have the same name as your source file, must end with .SCC, must be in the same folder as your .MPG file and must have corresponding time code.

Batch

Run the following command from a batch window
ExpCap Uncapptioned.mpg

Your transcribed caption file must have the same name as your source file, must end with .SCC, must be in the same folder as your .MPG file and must have corresponding time code.

6 Caption Embedding during Video Encoding

PixelTools Stand Alone Encoders

Encoders as listed in Chapter 5 can embed closed captioning into video during the encoding of the video in compliance with broadcasting specifications. The movie speech must be transcribed into one of the Closed Caption Transcription Formats listed in Chapter 4 prior to encoding.

Use the Configure |Encode | Line 21 dialog to configure the closed captioning insertion. Refer to the product manual for details on the closed captioning options.

Typical settings are:
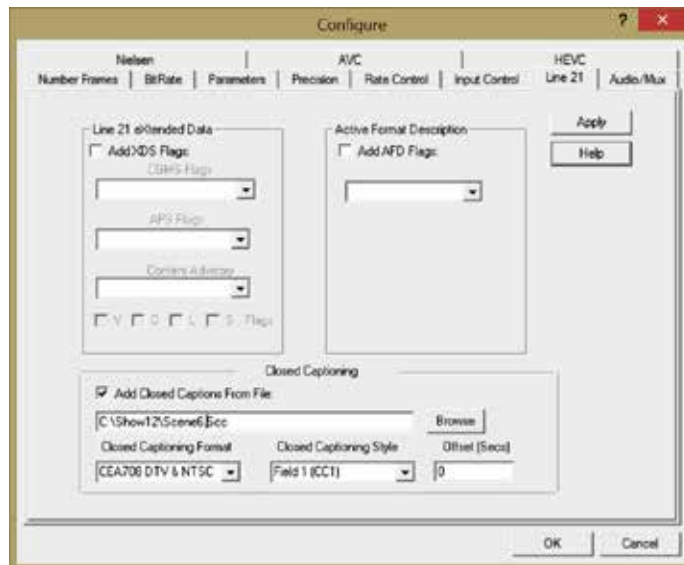
When you run the encoder, the captions defined in your transcription file will be inserted in the video at the appropriate times.

PixelTools Plug-In Encoders

The PixelTools Expert-Broadcast Premiere plug-in can embed closed captions directly into the video during encoding. The captions comply with broadcast specifications and are not in a Premiere "side car" file.

Set up the Embedded Captions tab of the PixelTools Exportor as appropriate for your captioning. Refer to the users manual for details of the settings.

When you run the export, the captions defined in your transcription file will be inserted in the video at the appropriate times.
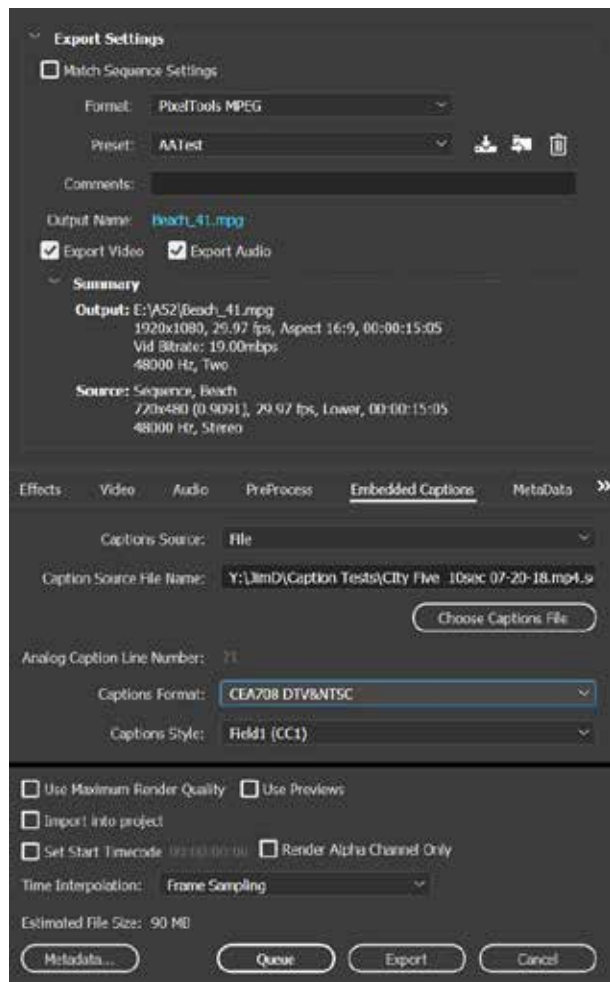
Special Closed Caption Encode Features

Open Captions
The Close Caption Style of Open Captions causes the transcribed captions to be "burned" into the video so that they will always be displayed over the video. The Analog Captions are rendered as CEA-608 captions

Analog Captions
The Closed Captioning Style of Analog causes the encoder to embed the original analog line 21 captions into one of the lines of the video

7 Caption Embedding into Existing Video

PixelTools Decoding products, listed in Chapter 5, can embed closed captioning into an existing video without transcoding. This results in no loss of video quality and high processing speed. The captions are embedded in the video stream in compliance with broadcasting specifications. The movie speech must be transcribed into one of the Closed Caption Transcription Formats listed in Chapter 4 prior to starting the process.

Select your caption settings in the Decode | Configure | Fix Stream dialog. Refer to the product manual for setting details. A typical setup is:
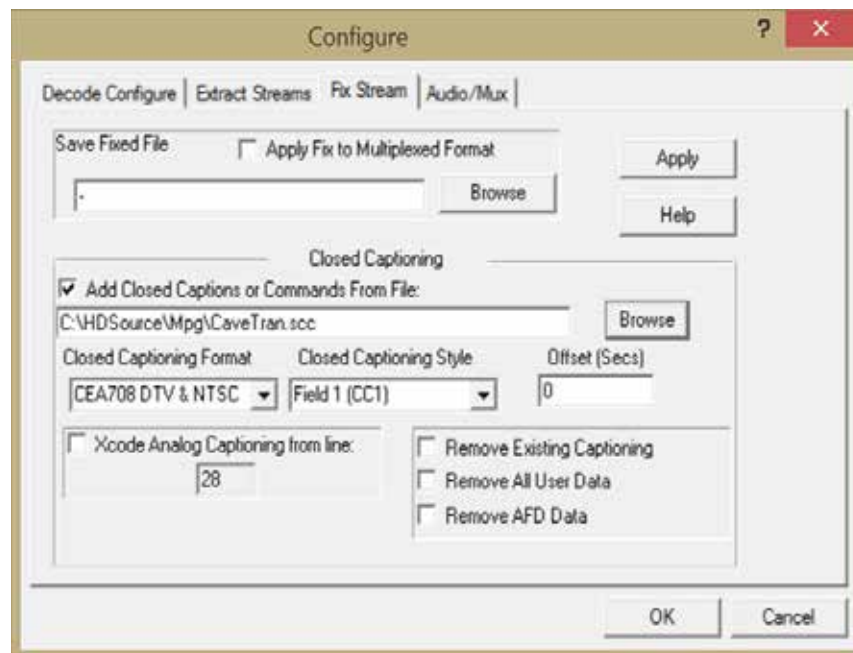
Special Closed Caption Features

Drag and Drop Captioning
The tool will add default captions with default settings by simple dragging the uncaptioned video file onto the unlaunched program icon

Remove Existing Captioning
The tool can be set up to remove any captions in the video stream before adding your desired captions

Analog Caption Source
The tool can be configured to interpret the lines of analog captioning as the transcribed caption source.

8 Additional Information and Resources

The Closed Captioning Handbook by Gary D Robson
Elsevier 2004

ANSI/CEA-708-E
August 2013
Consumer Electronics Association
Approved American National Standard

CEA-608-C Line 21 Data Service
August 2005 Consumer Electronics Association

ATSC Digital Television
Part 4-MPEG-2 Video System Characteristics
Document A/53 Part4:2009
Advanced Television Systems Committee, Inc

PixelTools Captioning Technical Tips

Closed Caption Insertion

https://www.pixeltools.com/tech_tip_closed_captioning.html

 Overview of closed captioning with PixelTools products
 Table of closed captioning features of PixelTools products
 Video demonstrations of captioning capabilities
 Details of captioning formats
 Adding captioning during encoder
 Embedding captioning into existing streams
 Closed captioning standards

Drag and Drop Insertion

https://www.pixeltools.com/tech_tip_drop_drag.html

Drag and Drop and captioning details

 Easy caption insertion using Expert-Caption
 Advanced captioning features
 Caption verification and debugging
 Expert-Caption operational hints

Closed Captioning Insertion into Existing MPEG streams

https://www.pixeltools.com/tech-tip-closed-captioning-existing.html

More details .. redundant .. Out of Date

 Adding captions during encoding or to existing streams
 Captioned video samples
 Details of closed captioning formats
 Specifications

PixelTools

Closed Captioning (line 21) insertion

https://www.pixeltools.com/tech_tip_closed_captioning_line21.html

More details .. redundant

    Adding captions during encoding or to existing streams
    Captioning details
    Analyzing captioning
    Extracting closed captioning
    Specifications

Insert SRT Captioning into MPEG

https://www.pixeltools.com/tech_tip_SRT.html

    Inserting .srt captioning format into MPEG using Expert-Caption

SMPTE-TT Caption Insertion

https://www.pixeltools.com/pt/tech_tip_smptea.html

    Adding SMPTE-TT captioning
    SMPTE-TT example

Adding Multiple Closed Captioning Tracks to a MPEG or AVC file

https://www.pixeltools.com/tech_tip_multiple_closed_captions.html

    Adding 2 to 4 different caption tracks to video

Exporting Embedded Captions with Adobe Premiere

https://www.pixeltools.com/pt/premiere_captioning.html

    Exporting MPEG with embedded (not side car) captions

Adding Active Format Description

https://www.pixeltools.com/tech_tip_active_format.html

    Inserting AFD during encoding or to and existing stream

Converting captioned MXF file into captioned transport streams

https://www.pixeltools.com/tech_tip_mxf_closed_captions.html

Transcoding OP1a MXF file into MPEG Transports Stream with Captions

Running MPEGRepairHD from GUI and from batch

Extracting caption track from MXF file

https://www.pixeltools.com/tech_tip_mxf_extraction.html

Saving MXF caption track as PixelTools edl file

Using MPEGRepairHD and Expert-Caption to extract MXF caption track

Extract, Insert, Transcode and View analog captioning

https://www.pixeltools.com/tech_tip_analog_captions.html

Encoding analog captions using MPEGRepairHD

Viewing and extracting analog captions

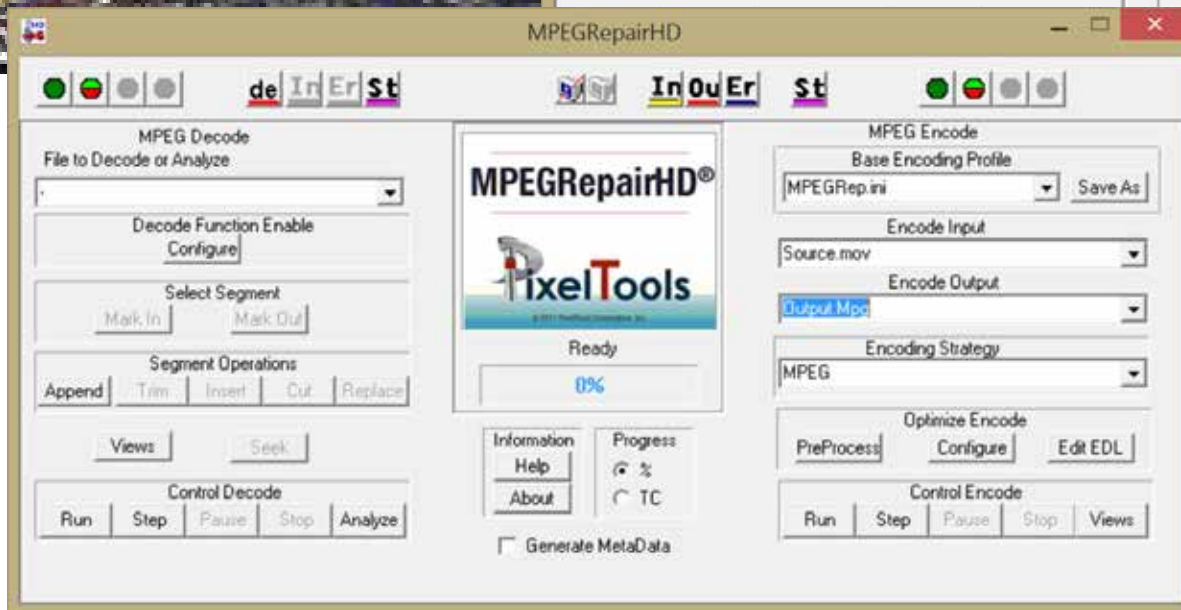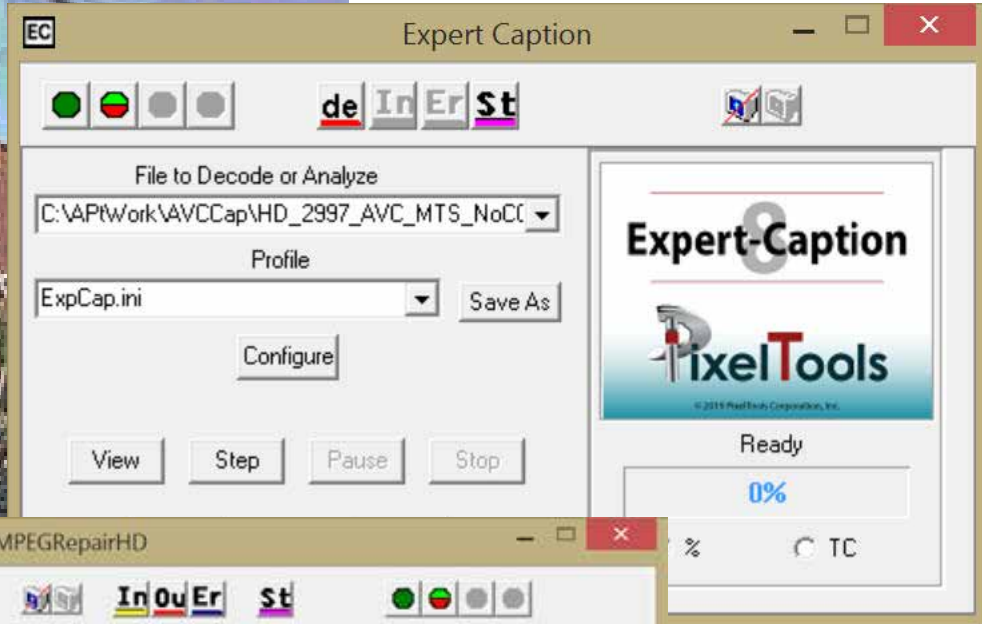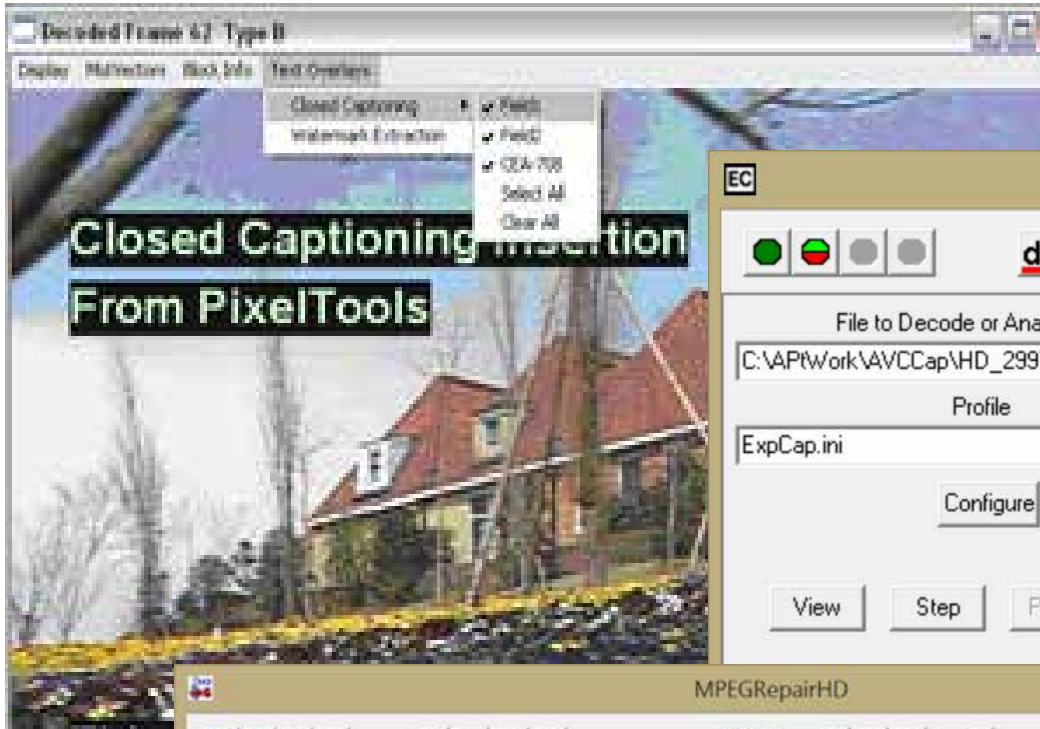**Open Caption Insertion**

https://www.pixeltools.com/tech_tip_open_caption_insertion.html

Encoding open captions using MPEGRepairHD

Logo Insertion

https://www.pixeltools.com/tech_tip_logo_insertion.html

Burning logos into video during encoding

Decoded Frame 62 Type B

Display Multirectors Block Info Text Overlays:

Closed Captioning ▸ ✔ Field1
Watermark Extraction   ✔ Field2
                        ✔ CEA-708
                        Select All
                        Clear All

Closed Captioning Insertion From PixelTools

EC Expert Caption — □ ✕

de In Er St

File to Decode or Analyze
C:\APt\Work\AVCCap\HD_2997_AVC_MTS_NoC0 ▾

Profile
ExpCap.ini ▾   Save As

Configure

View   Step   Pause   Stop

Expert-Caption
PixelTools
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Ready
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MPEGRepairHD — □ ✕

de In Er St   In Ou Er St

MPEG Decode
File to Decode or Analyze
. ▾

Decode Function Enable
Configure

Select Segment
Mark In   Mark Out

Segment Operations
Append Trim Insert Cut Replace

Views   Seek

Control Decode
Run Step Pause Stop Analyze

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Ready
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Information
Help
About

Progress
○ %
○ TC

☐ Generate MetaData

MPEG Encode
Base Encoding Profile
MPEGRep.ini ▾ Save As

Encode Input
Source.mov ▾

Encode Output
Output.Mpg ▾

Encoding Strategy
MPEG ▾

Optimize Encode
PreProcess   Configure   Edit EDL

Control Encode
Run Step Pause Stop Views

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PixelTools has been developing compression systems and tools in support of broadcast and file based digital video since the conception of MPEG in the 1990s. The PixelTools process, our magic, our secret sauce, is that we have developed a quality measure that is able to, on a frame-by-frame basis, drive the encoder to the lowest bitrate possible before it introduces artifacts.

www.pixeltools.com