



Emerging Issues

An Introduction to Recording, Editing, and Streaming Picture-in-Picture Ultrasound Videos

Sathish Rajasekaran, MD, Mederic M. Hall, MD, Jonathan T. Finnoff, DO

Abstract

This paper describes the process by which high-definition resolution (up to 1920×1080 pixels) ultrasound video can be captured in conjunction with high-definition video of the transducer position (picture-in-picture). In addition, we describe how to edit the recorded video feeds to combine both feeds, and to crop, resize, split, stitch, cut, annotate videos, and also change the frame rate, insert pictures, edit the audio feed, and use chroma keying. We also describe how to stream a picture-in-picture ultrasound feed during a videoconference.

Introduction

With the expansion of ultrasonography, the need to capture high-quality videos of the scan has increased for clinical, research, and educational use. A technique for recording picture-in-picture ultrasound videos has been described previously [1]. Although innovative at the time, its major limitation was that the ultrasound stream was recorded in standard definition (640×480 pixels). Because several ultrasound machines, even portable machines, stream at high definition resolutions, this is a considerable weakness. The previous methodology also used a freeware program, which had limited postproduction editing capabilities.

This paper describes the process by which high-definition resolution (up to 1920×1080 pixels) ultrasound feeds can be captured in conjunction with high-definition video of the transducer position (picture-in-picture). In addition, we describe how to combine both video feeds; crop, resize, split, stitch, cut, and annotate videos; and also change the frame rate, insert pictures, edit the audio feed, and use chroma keying. We also describe how to stream a picture-in-picture ultrasound feed during a videoconference. Creating high-quality, edited picture-in-picture ultrasound videos allows for the dissemination of knowledge in the form of peer-reviewed publications, and the creation of effective educational material that can be shared locally or regionally by archiving videos online. In addition, the

streaming technique provides a means for providing live education sessions between remote sites, which in itself may recoup the equipment costs associated with this technique.

Methods*Initial Setup**Computer*

A laptop or desktop is required for this setup. A computer with a discrete video card provides better performance for this setup. At least 2 universal serial bus (USB) input connections are required (1 USB 3.0 and 1 USB 2.0 or greater). In regards to the processor, the minimum requirements are currently unknown, but as a general rule a more powerful processor is required if a low-voltage processor (most laptops) is used.

Video Capture Device

In recent years, the number of high-definition multimedia interface (HDMI) video capture devices that connect to computers via a USB connection has increased. Most capture cards can stream in standard aspect ratios (16:9 or 4:3). We suggest the reader ascertain their ultrasound machine's aspect ratio, as some capture cards cannot stream in nonstandard aspect ratios. Most devices can be connected as outlined in [Figure 1](#).



Figure 1. White arrow, universal serial bus (USB) video capture device (Magewell). Void arrow, USB connection to computer. Void arrowhead, high-definition multimedia interface (HDMI) connection to ultrasound machine. White arrowhead, quarter for size reference.

Webcam

Several options exist for webcam devices. We suggest using one that uses the Moving Picture Experts Group 4 Advanced Video Coding (MPEG-4 AVC), more commonly known as the H.264 video compression format. In addition, we suggest one that can be mounted on the ultrasound screen, placed on a stand, or attached to a tripod (Figure 2). If recording audio during the scanning session, the webcam's microphone

can be used. In instances in which higher audio quality is required, audio can be added postrecording, and a higher-quality (eg, cardoid) microphone can be used.

Video Capture Software

Several options exist for video capture, and editing. The reader can demo available options and choose one that is user-friendly, offers postediting options, and allows one to record videos using the editing program or to import prerecorded videos.

Video Recording

The video capture device can be setup as described in Figures 1 and 2. One has the option of using the program to record both feeds simultaneously (ultrasound and webcam); however, we discourage this setup because the webcam feed's resolution is downgraded in most video capture programs and the video appears pixelated. We suggest recording both feeds



Figure 2. Different options for webcam placement. (A) Mounted on ultrasound machine screen. (B) Placed on stand. (C) Attached to tripod.

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