Claims

1. An intelligent medical display system, comprising a video acquisition module, an artificial intelligence (AI) edge computation module, a marking layer output module, a video overlaying module, and a display module, wherein

the video acquisition module is configured to receive a video input signal from a medical imaging device and transmit the video input signal to the AI edge computation module;

the AI edge computation module is configured to analyze the video input signal to obtain and push a lesion target detection message, a lesion segmentation message, and a semantic scene detection message to the marking layer output module;

the marking layer output module comprises an information processing submodule and an image pushing submodule, the information processing submodule is configured for packet marking on the messages pushed by the AI edge computation module, and divide the messages into a lesion target detection message packet, a lesion segmentation message packet, and a semantic scene detection message packet, and the image pushing submodule is configured to mark a background image according to a packet marking result of the information processing submodule, to form and output a lesion target detection result video, a lesion segmentation result video, and a semantic scene detection result video to the video overlaying module;

the video overlaying module is configured to overlay the lesion target detection result video, the lesion segmentation result video, and the semantic scene detection result video from the image pushing submodule and the video input signal from the video acquisition module and output an overlaid video to the display module; and

the display module is configured to display the overlaid video;

the image pushing submodule comprises a texture channel creation unit, a texture channel context creation unit, a background image drawing unit, a graphic drawing unit, and a video output unit;

the texture channel creation unit is configured to create and bind a lesion target detection texture channel, a lesion segmentation texture channel, and a semantic scene detection texture channel to three output ports respectively;

the texture channel context creation unit is configured to create a lesion target

detection texture channel context, a lesion segmentation texture channel context, and a semantic scene detection texture channel context for the three output ports respectively;

the background image drawing unit is configured to draw background images in the lesion target detection texture channel, the lesion segmentation texture channel, and the semantic scene detection texture channel respectively;

the graphic drawing unit draws a lesion target graphic on the background image in the lesion target detection texture channel based on the lesion target detection message packet, draws a lesion segmentation graphic on the background image in the lesion segmentation texture channel based on the lesion segmentation message packet, and draws a semantic scene graphic on the background image in the semantic scene detection texture channel based on the semantic scene detection message packet; and

the video output unit is configured to form the background image and the lesion target graphic drawn thereon into the lesion target detection result video, form the background image and the lesion segmentation graphic drawn thereon into the lesion segmentation result video, and form the background image and the semantic scene detection graphic drawn thereon into the semantic scene detection result video, and output such videos to the video overlaying module through the three output ports respectively.

2. The intelligent medical display system according to claim 1, characterized in that the information processing submodule comprises a first buffer and a lesion target detection buffer, a lesion segmentation buffer, and a semantic scene detection buffer that are connected to the first buffer; the first buffer is connected to the AI edge computation module to receive and temporarily store the message pushed by the AI edge computation module and parse a message header of the message; and according to the message header, the lesion target detection message is temporarily stored in the lesion target detection buffer, the lesion segmentation message is temporarily stored in the lesion segmentation buffer, and the semantic scene detection message is temporarily stored in the semantic scene detection buffer, so as to be divided into the lesion target detection message packet, the lesion segmentation message packet, and the semantic scene detection message packet respectively.

3. The intelligent medical display system according to claim 1, characterized in that the video overlaying module comprises four input terminals and one output terminal, the

four input terminals are configured to receive the lesion target detection result video, the lesion segmentation result video, and the semantic scene detection result video that are from the video output unit and the video input signal from the video acquisition module, and the output terminal is configured to output the overlaid video to the display module.

4. The intelligent medical display system according to claim 3, characterized in that the video overlaying module performs video overlaying through the following steps:

1) creating and initializing a video input signal ring buffer, a lesion detection result video ring buffer, a lesion segmentation result video ring buffer, and a semantic scene detection result video ring buffer, and setting a capacity of each ring buffer;

2) creating four listening threads of input channels of the input terminals, wherein when the input terminals receive a video input, the input terminals write frame data to corresponding ring buffers respectively, and when the ring buffer is full, header frame data are popped while new frame data are inserted;

3) creating a misaligned output, that is, directly outputting, when the video input signal ring buffer reaches a preset storage length for first time, first frame data without any processing, wherein the first frame data in the video input signal ring buffer and first frame data in the other three ring buffers are misaligned by time of a frame; and

4) outputting an overlaid and synthesized AI frame.

5. The intelligent medical display system according to claim 4, characterized in that step 4) specifically comprises:

4.1) using output time of the first frame data of the video input signal occupied by the misaligned output for graphic overlaying on header first frame data of the lesion detection result video ring buffer, header first frame data of the lesion segmentation result video ring buffer, and header first frame data of the semantic scene detection result video ring buffer, and obtaining a synthesized AI graphic prompt signal; and

4.2) overlaying the synthesized AI graphic prompt signal and the frame data of the video input signal and obtaining the overlaid and synthesized AI frame.

6. The intelligent medical display system according to claim 1, characterized in that the AI edge computation module comprises a lesion target detection submodule, a lesion segmentation submodule, and a semantic scene detection submodule, the lesion target detection submodule is configured to recognize the video input signal frame by frame to

obtain a lesion detection object target, and convert the lesion detection object target into a message to obtain the lesion target detection message, the lesion segmentation submodule is configured to recognize the video input signal frame by frame to obtain a lesion segmentation object target, and convert the lesion segmentation object target into a message to obtain the lesion segmentation message, and the semantic scene detection submodule is configured to recognize the video input signal frame by frame to obtain a semantic scene detection result, and convert the semantic scene detection result into a message to obtain the semantic scene detection message.

7. The intelligent medical display system according to claim 6, characterized in that the lesion target detection message comprises a message header and a message body, the message header is DET, the message body comprises coordinates of a plurality of lesion detection object targets, and a plurality of coordinates are separated by a symbol "|"; the lesion segmentation message comprises a message header and a message body, the message header is SEG, the message body is a set of point coordinates of a plurality of lesion segmentation object targets, and a plurality of point coordinate sets are separated by a symbol |; and the semantic scene detection message comprises a message header and a message body, the message header is TXT, the message body comprises prompt words corresponding to a plurality of semantic scenes, and a plurality of prompt words are separated by a symbol |.

8. The intelligent medical display system according to claim 1, characterized in that the display module has an image input source switch button, the video acquisition module, the AI edge computation module, and the video overlaying module are all connected to the display module, and the image input source switch button is configured to determine whether a content displayed by the display module is from the video acquisition module, the AI edge computation module, or the video overlaying module.