# Auto-PCOS Classification Challenge

**Team name**: Levi's Legion

**Team member names and affiliation**:

| Members | Member Name | Affiliation |
|---|---|---|
| Member 1 | Kshitiz Kumar Singh | |
| Member 2 | Dr. Shrivishal Tripathi | |
| Member 3 | | |
| Member 4 | | |

**Contact number:7987040790**

**Email address**:kshitiz20100@iiitnr.edu.in

**Brief write up about the pipeline**:

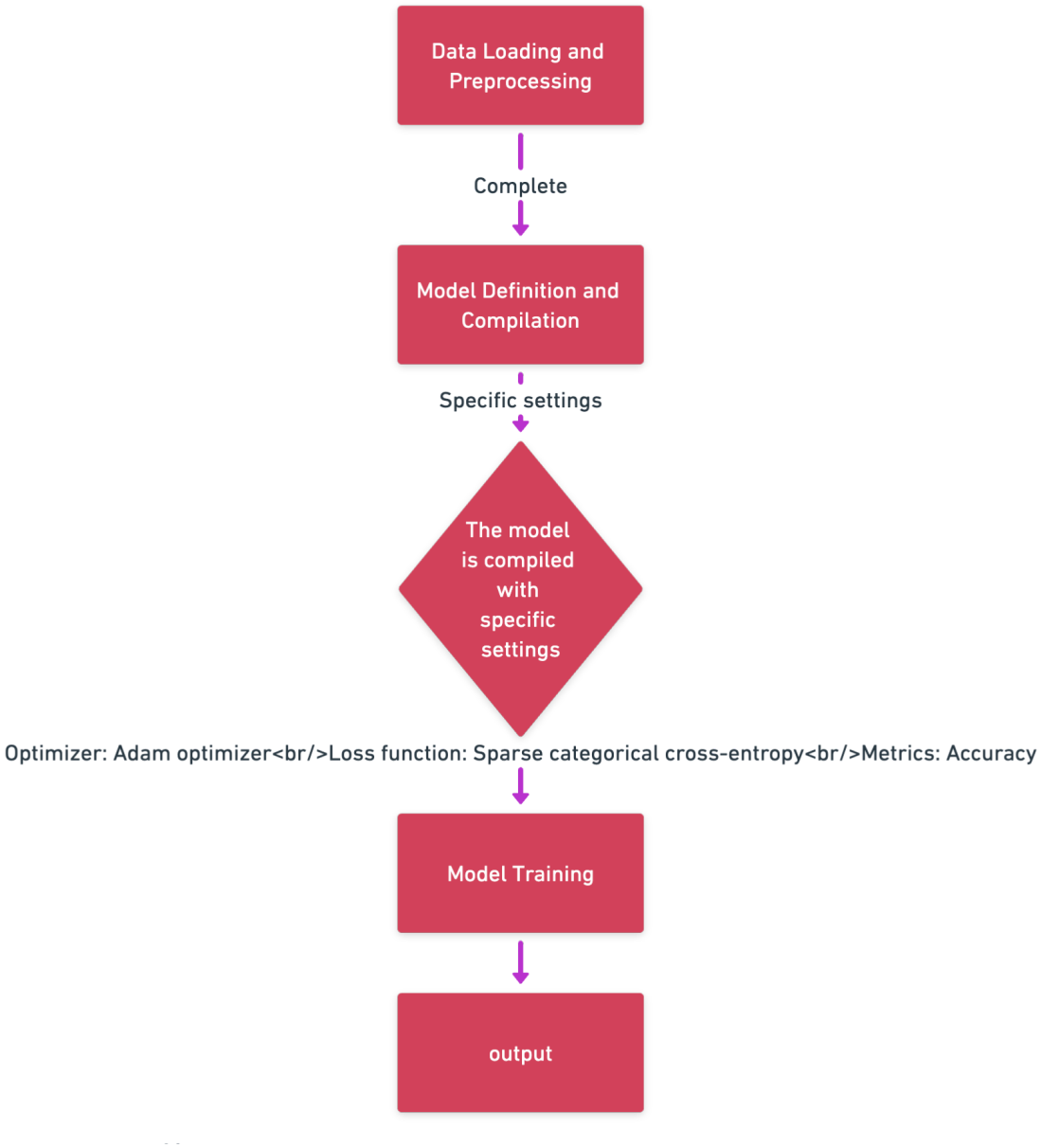
1. Data Loading and Preprocessing:
    - The code loads image data from the specified directory /kaggle/input/auto-pcos/train using tf.keras.utils.image_dataset_from_directory.
    - The data is split into a training subset, and a validation subset with a 80-20 split using the validation_split parameter.
    - Each image is resized to a height and width of 180 pixels, and the data is organized into batches of size 32 for efficient processing during training.
2. Model Definition and Compilation:
    - A convolutional neural network (CNN) model is defined using tf.keras.Sequential.
    - The model architecture consists of multiple convolutional layers with increasing filter sizes (32, 64, 128, 256), followed by max pooling layers to downsample the feature maps.
    - After the convolutional layers, the feature maps are flattened, and passed through dense layers with ReLU activation functions.
    - The output layer consists of num_classes neurons corresponding to the number of output classes.
    - The model is compiled with specific settings:
        - Optimizer: Adam optimizer is used for gradient-based optimization.
        - Loss function: Sparse categorical cross-entropy is used as the loss function, suitable for integer-encoded class labels.
        - Metrics: The model's performance is evaluated based on accuracy during training.
3. Model Training:
    - The model is trained on the training dataset (train_ds) using the model.fit method for 50 epochs.
4. Model Testing on validation data
5. Gradcam is implemented by saving the model.

**Model: "sequential_1"**

| Layer (type) | Output Shape | Param # |
|---|---|---|
| reshape (Reshape) | (None, 180, 180, 3) | 0 |
| rescaling_1 (Rescaling) | (None, 180, 180, 3) | 0 |
| conv2d_3 (Conv2D) | (None, 173, 173, 256) | 49,408 |
| max_pooling2d_3 (MaxPooling2D) | (None, 86, 86, 256) | 0 |
| conv2d_4 (Conv2D) | (None, 71, 71, 128) | 8,388,736 |
| max_pooling2d_4 (MaxPooling2D) | (None, 35, 35, 128) | 0 |
| conv2d_5 (Conv2D) | (None, 4, 4, 64) | 8,388,672 |
| max_pooling2d_5 (MaxPooling2D) | (None, 2, 2, 64) | 0 |
| flatten_1 (Flatten) | (None, 256) | 0 |
| dense_2 (Dense) | (None, 256) | 65,792 |
| dense_3 (Dense) | (None, 128) | 32,896 |
| dense_4 (Dense) | (None, 2) | 258 |

**Total params:** 16,925,762 (64.57 MB)
**Trainable params:** 16,925,762 (64.57 MB)
**Non-trainable params:** 0 (0.00 B)

**Figure of the developed pipeline**:




**Achieved results on validation dataset including**:

- A table of the achieved evaluation metrics on validation dataset for automatic classification of healthy and un-healthy frames in ultrasound imaging:

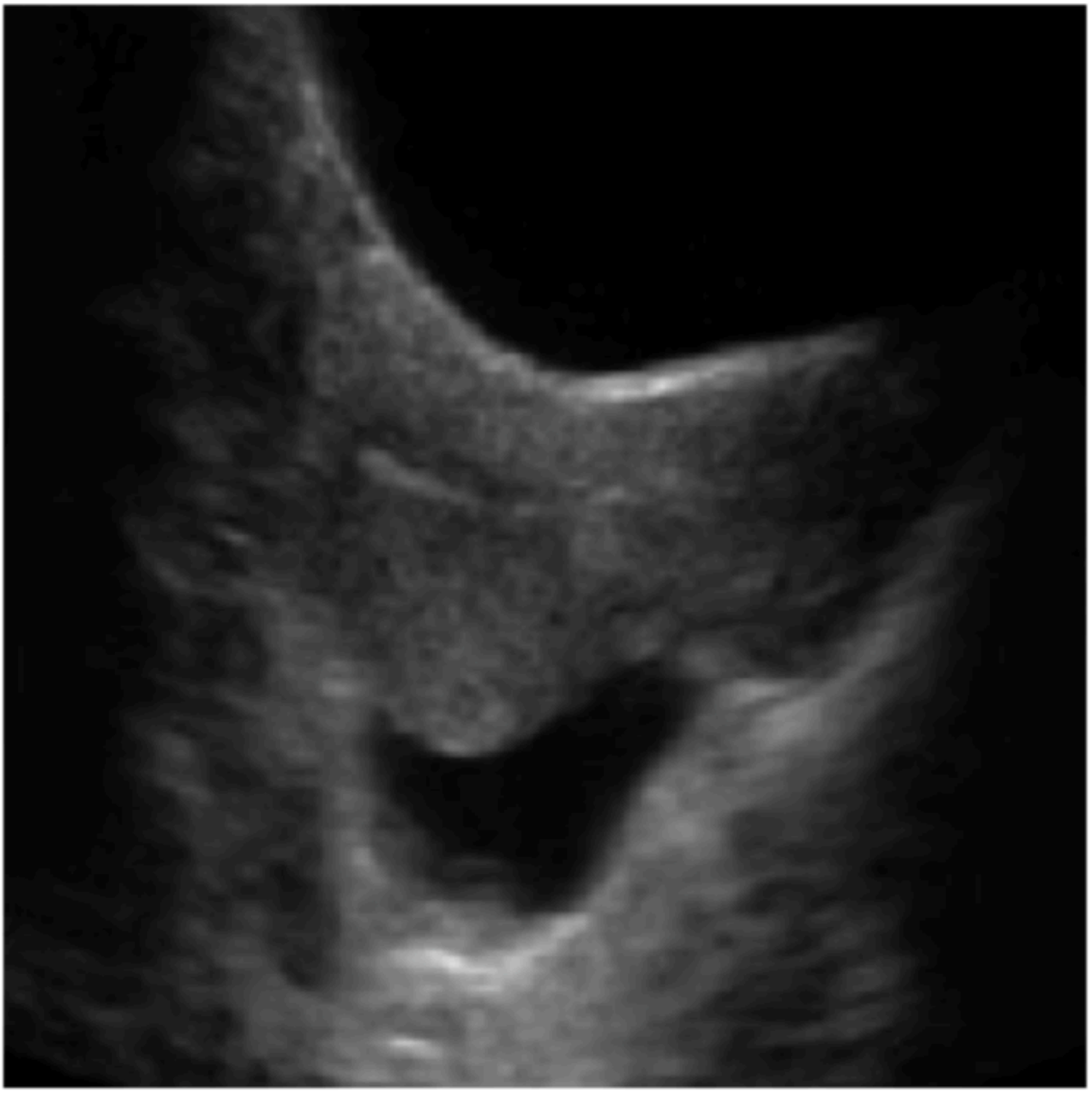
| | Training | Validation |
|---|---|---|
| Accuracy | 91 | 71 |

- Pictures (resolution 600 DPI) of any 5 best frames selected from validation dataset showing its classification:

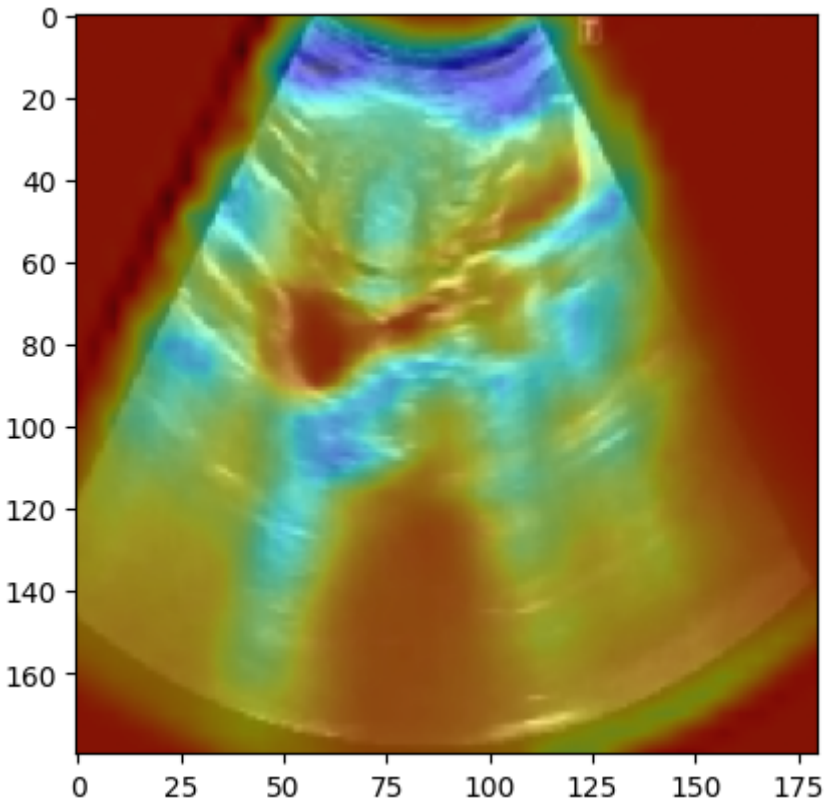
Prediction: Unhealthy (Confidence: 99.99%)

Prediction: Unhealthy (Confidence: 99.90%)

Prediction: Healthy (Confidence: 100.00%)




- Pictures (resolution 600 DPI) of achieved interpretability plots of any 5 best frames selected from validation dataset: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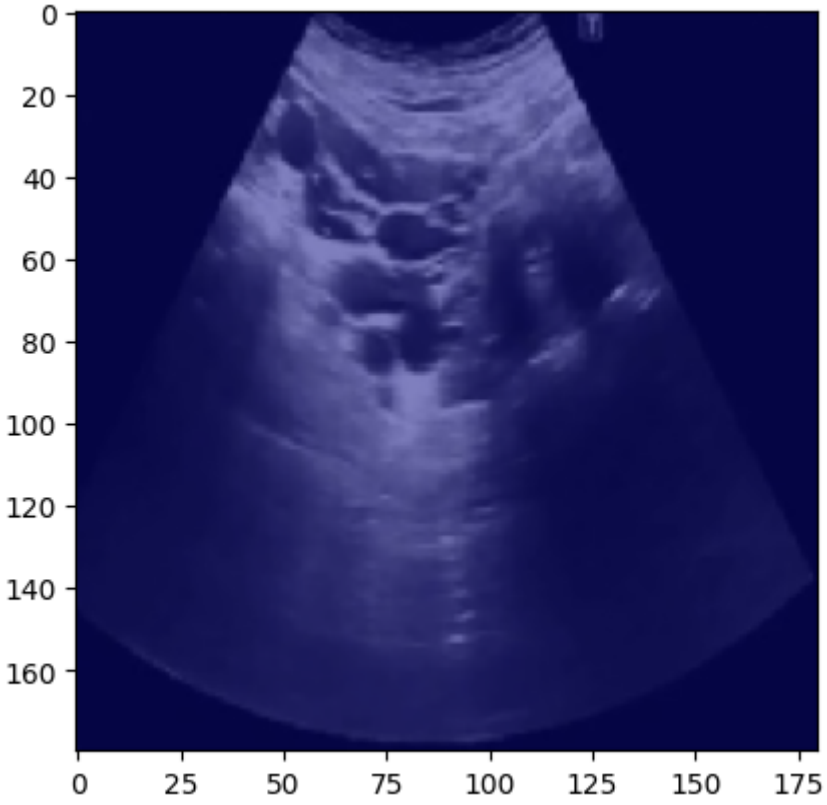
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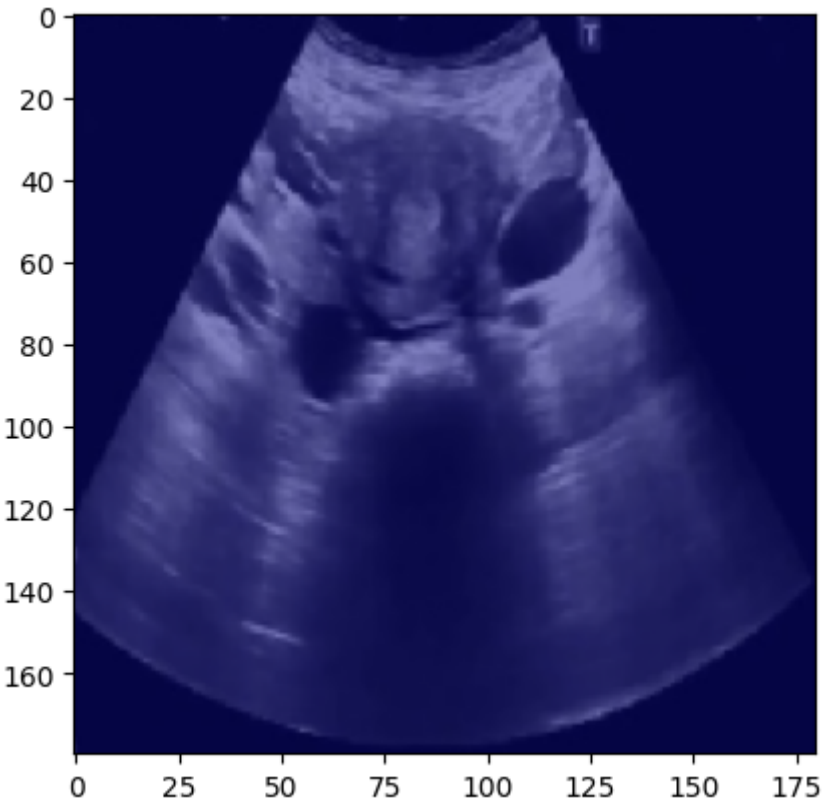
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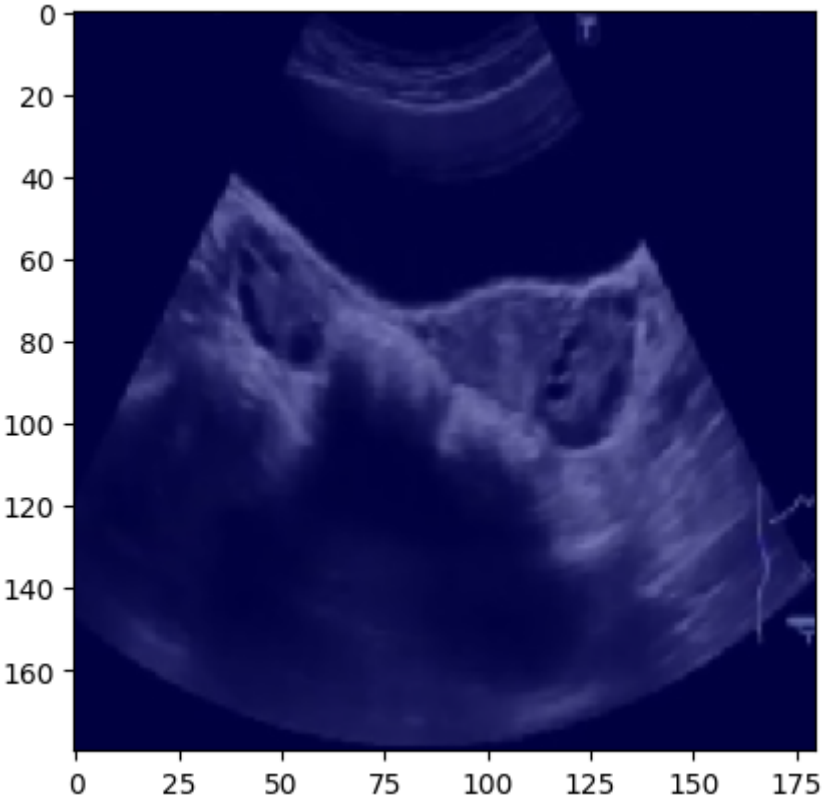
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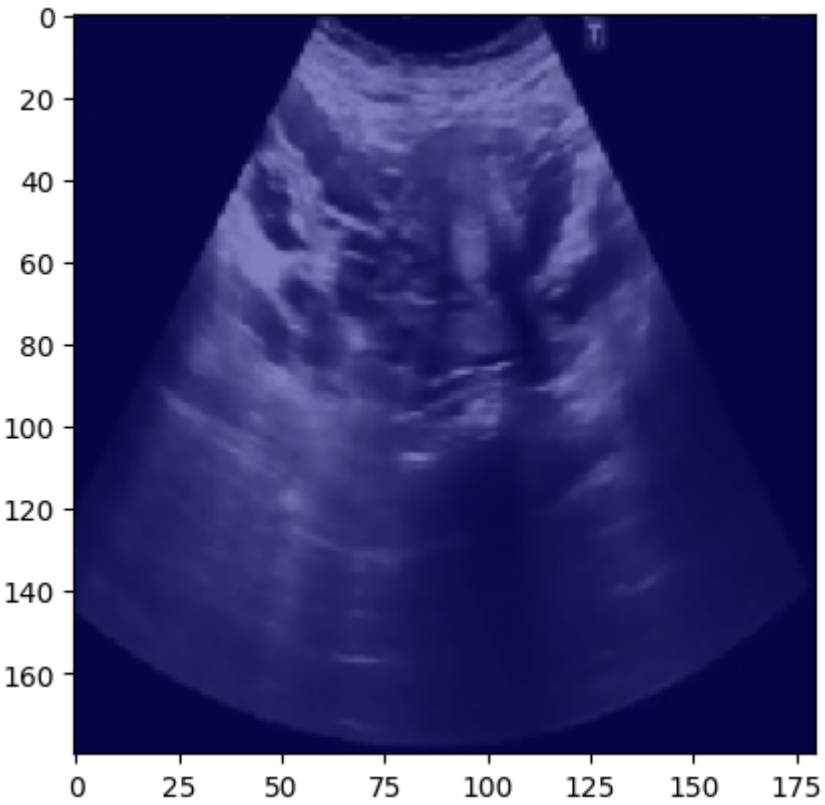
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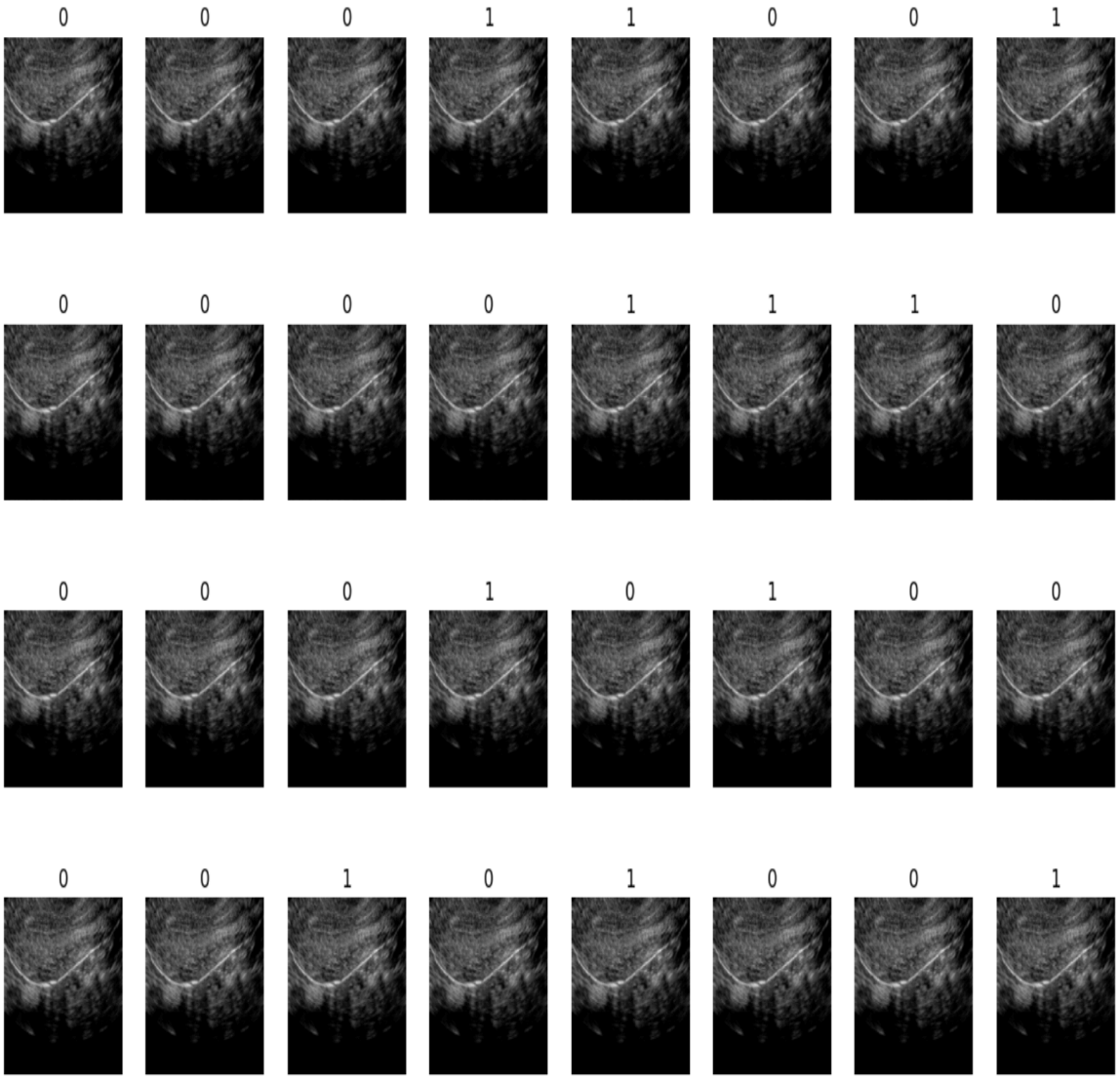
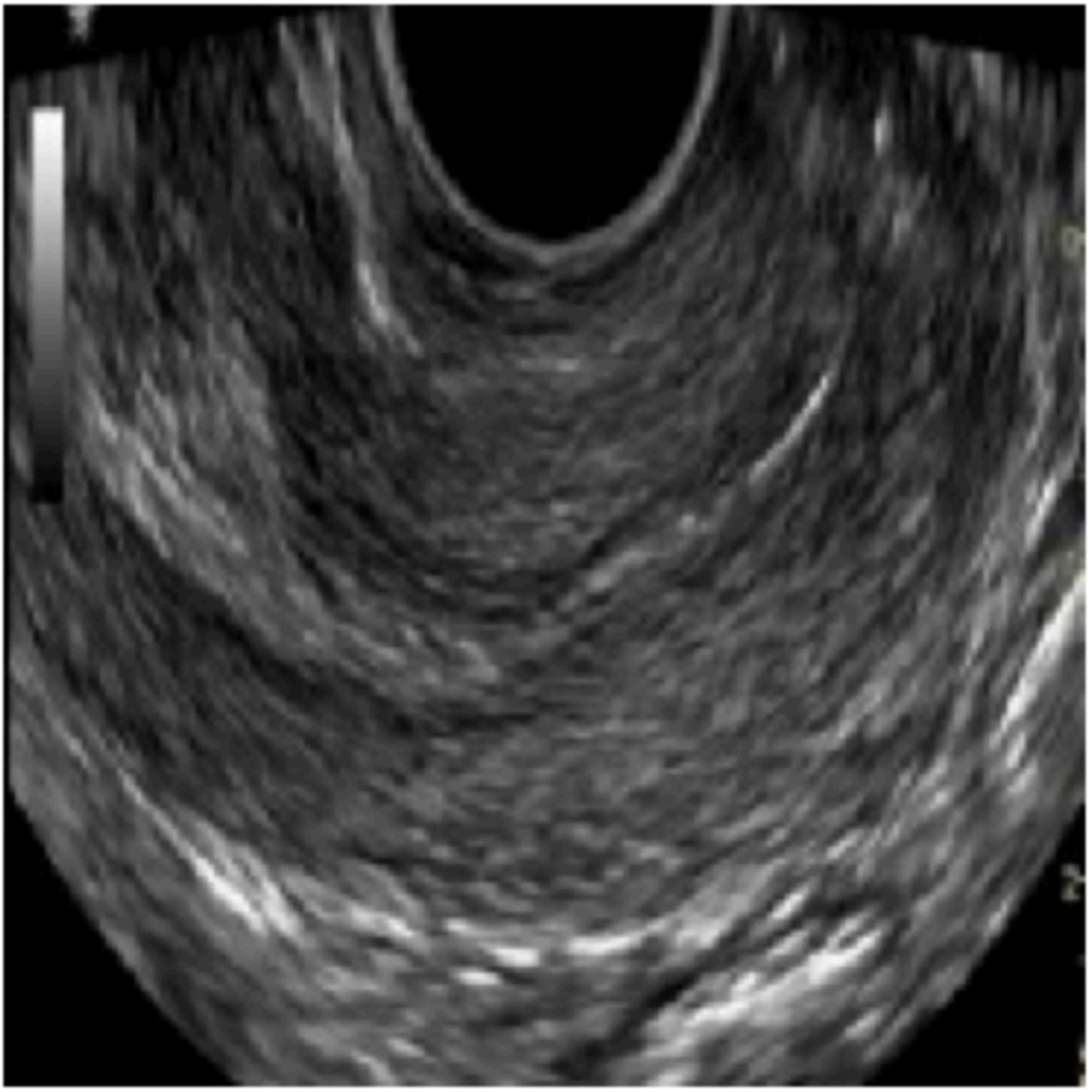
**Achieved results on testing dataset including**:

- Pictures (resolution 600 DPI) of any 5 best frames selected from testing dataset showing its classification:

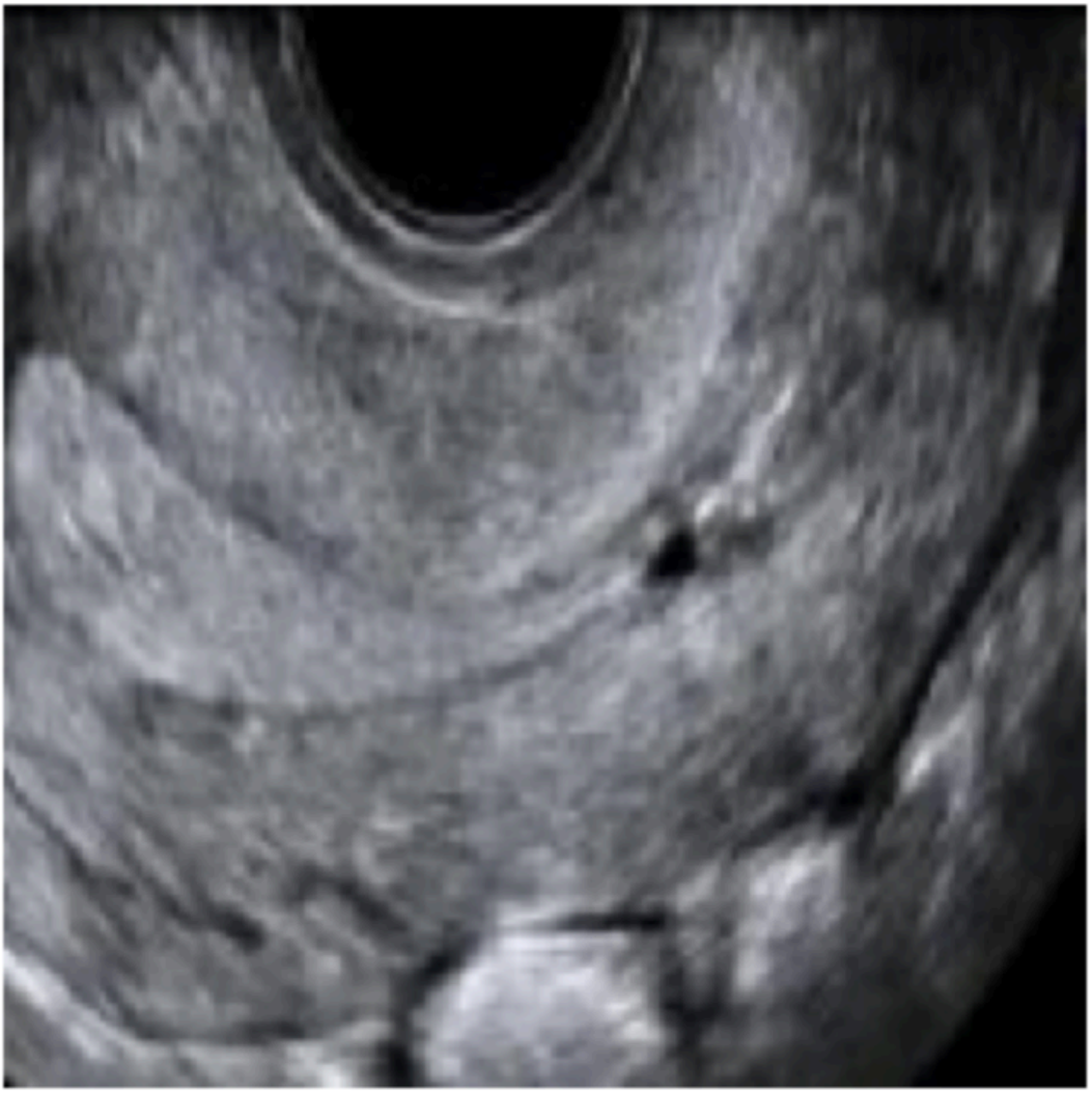


Prediction: Unhealthy (Confidence: 100.00%)

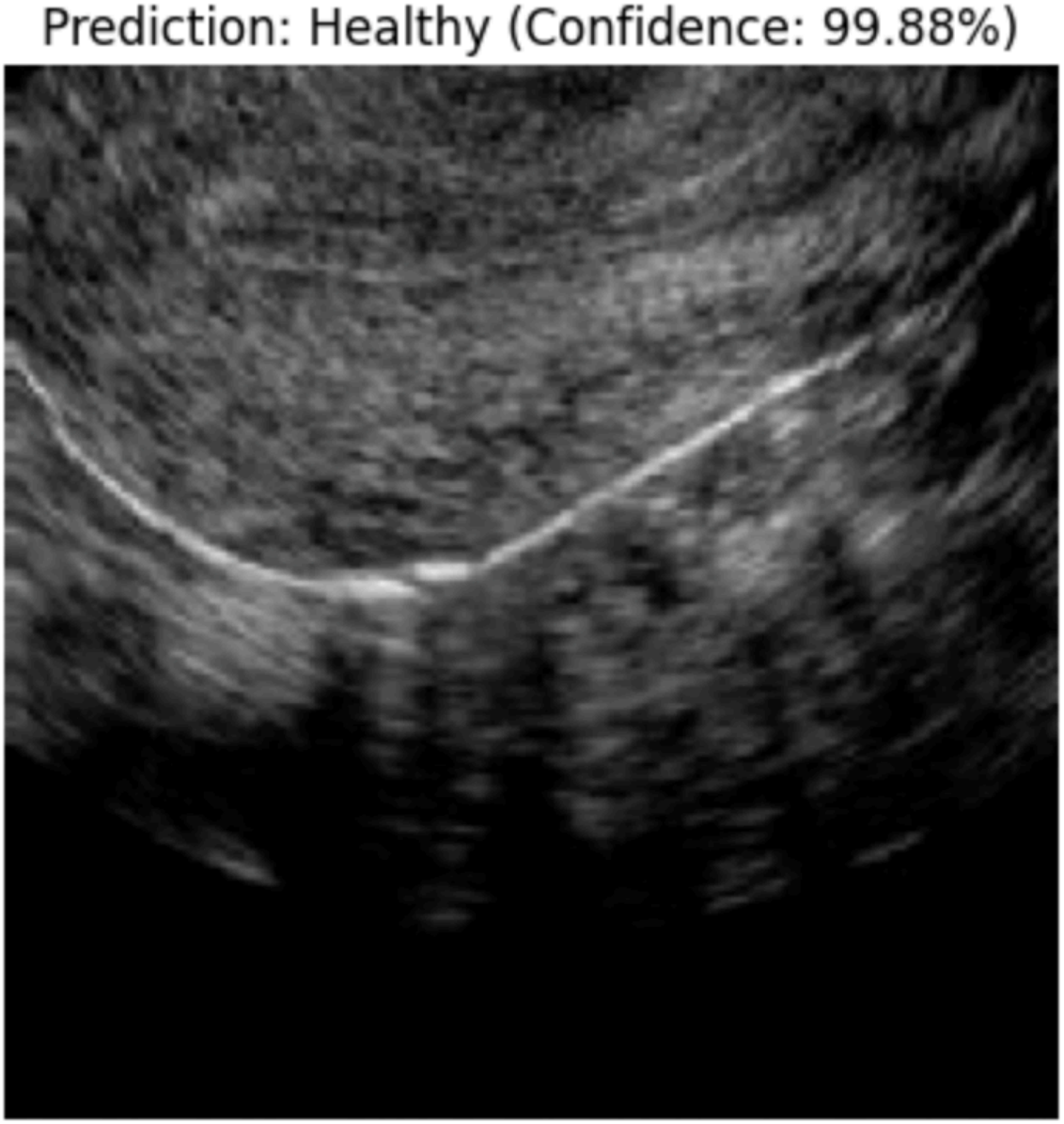
Prediction: Unhealthy (Confidence: 99.84%)



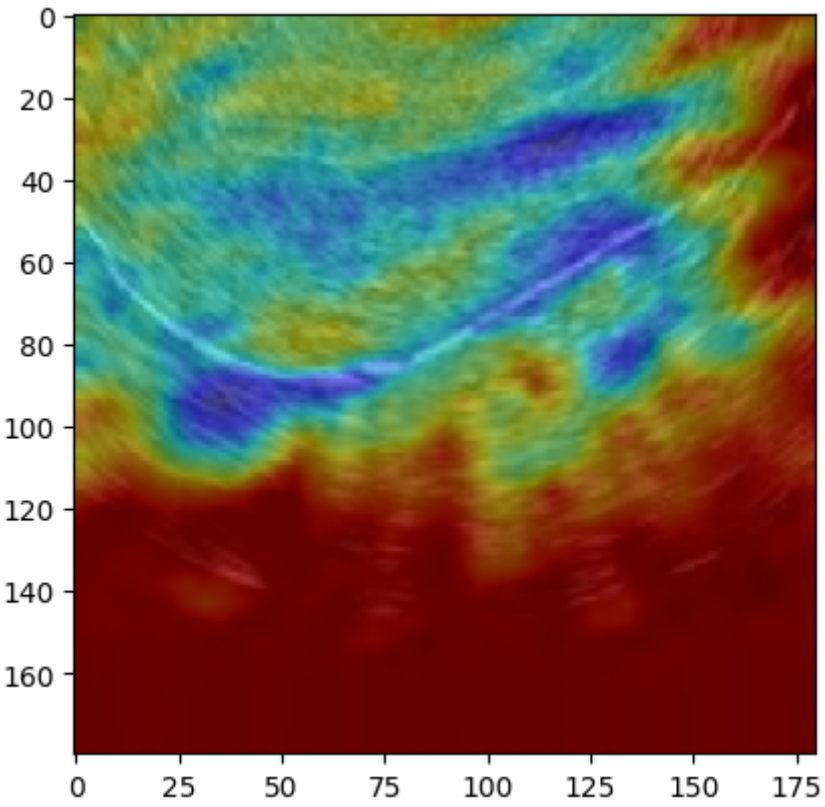
Prediction: Unhealthy (Confidence: 100.00%)



Prediction: Unhealthy (Confidence: 100.00%)




- Pictures (resolution 600 DPI) of achieved interpretability plot of any 5 best frames selected from testing dataset: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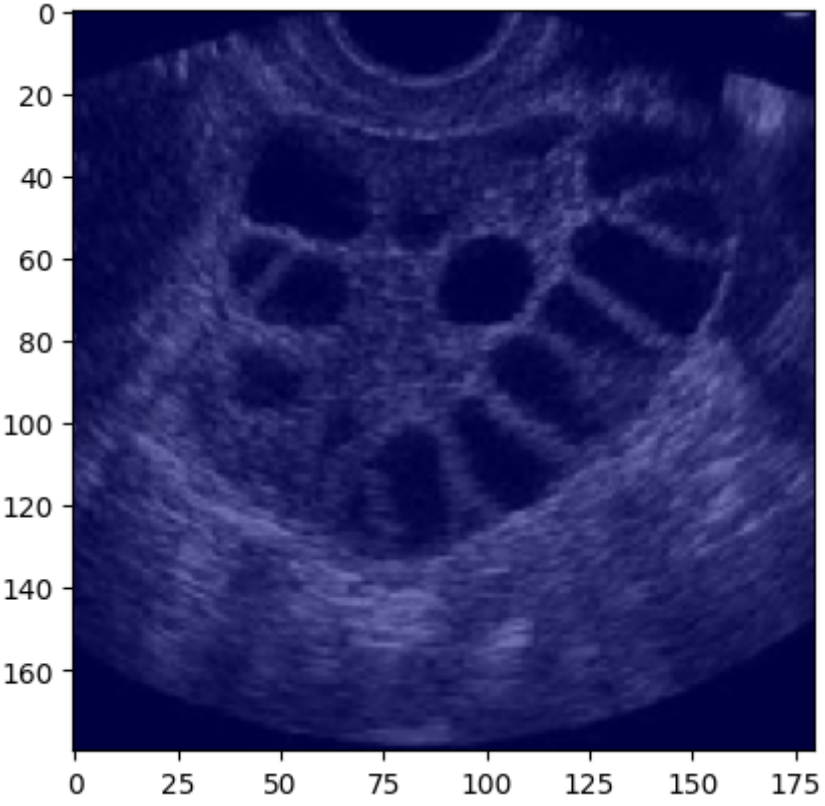
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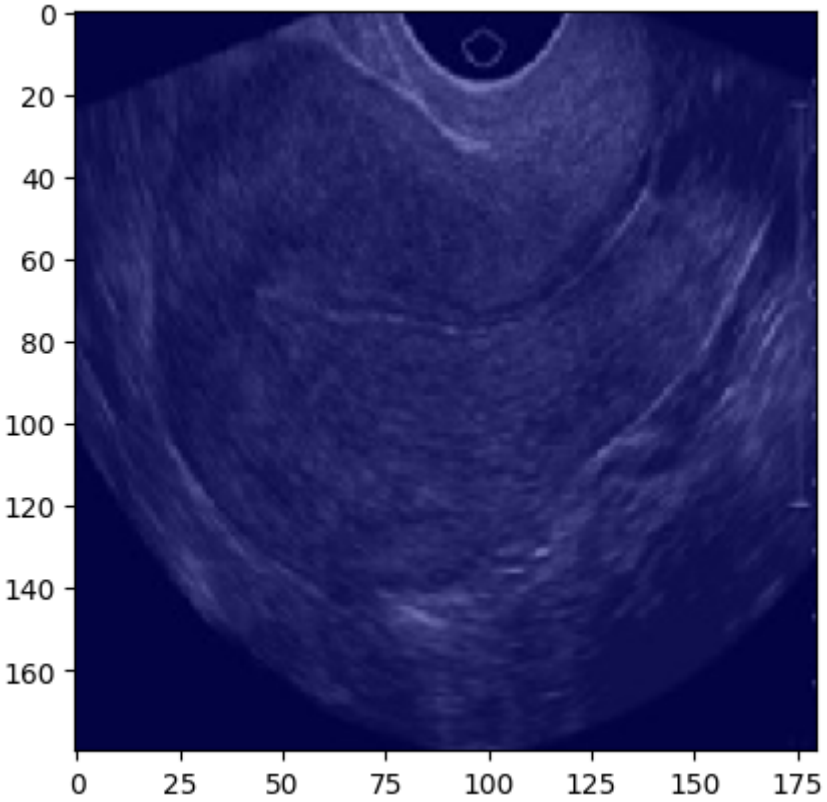
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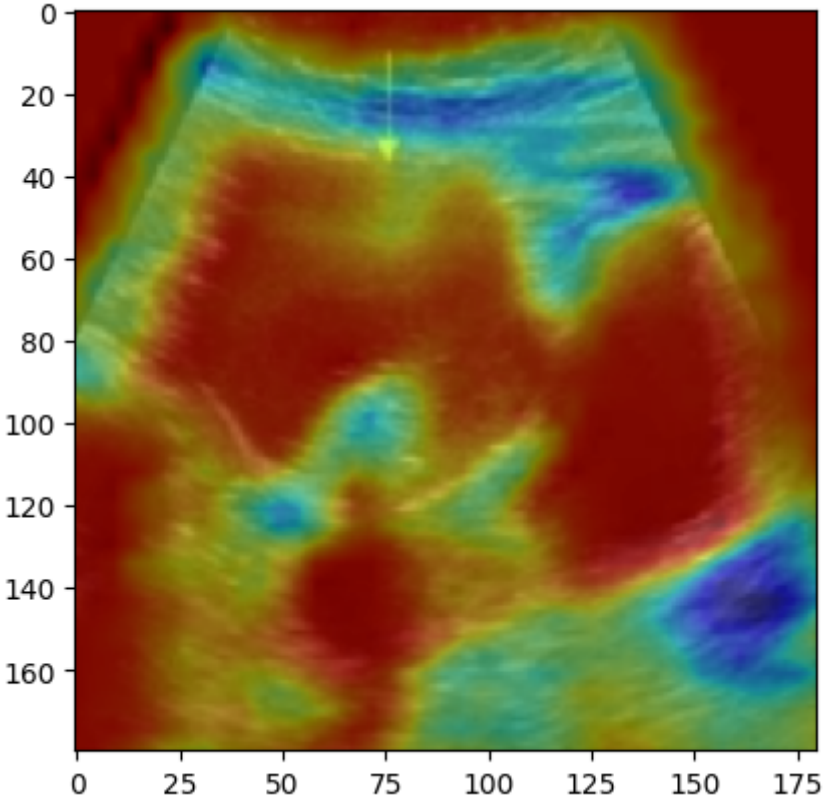
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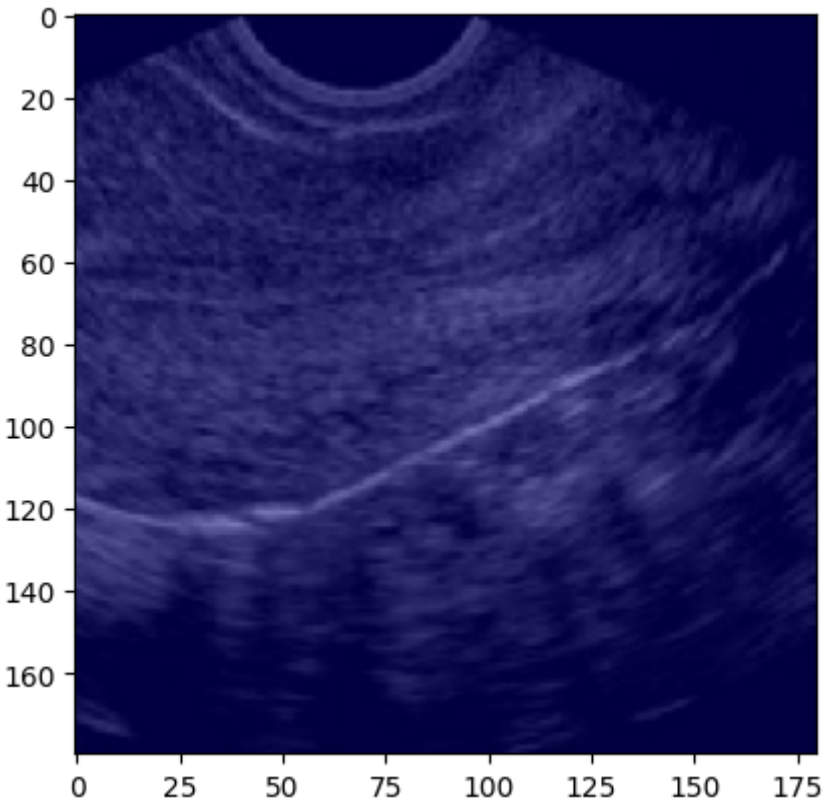
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