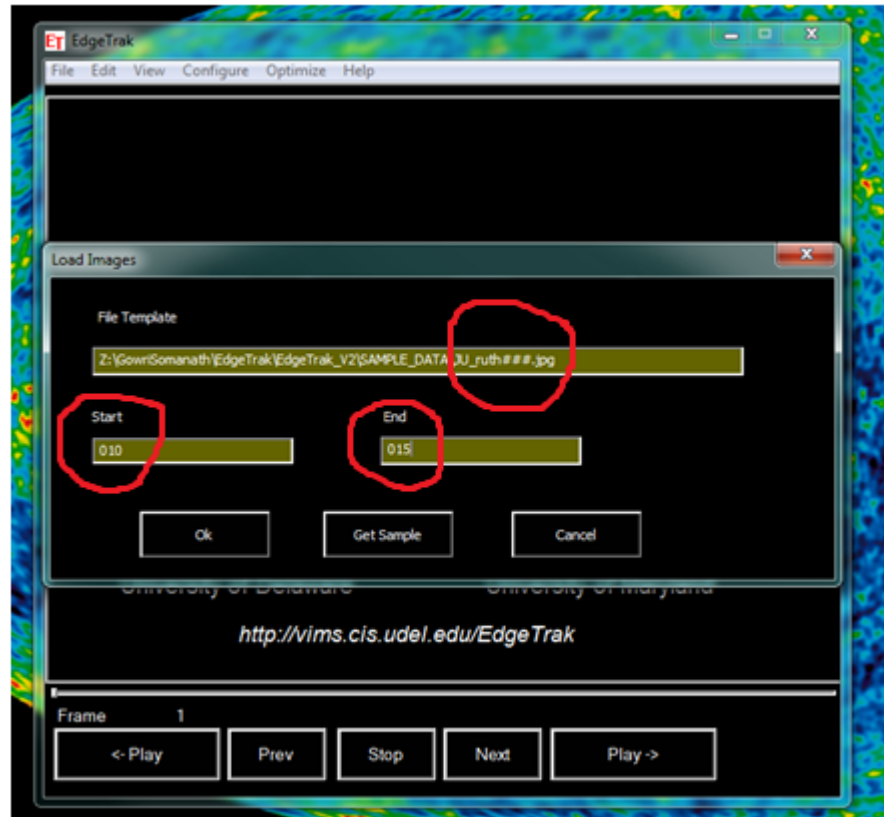


### **General Information:**

- EdgeTrak is a program for tracking contours in sequences of black and white images, such as ultrasound images. Open-contours are extracted from the lower edge of a white to black gradient image.
- The program reads in a sequence of .jpg (or .ras, .tif) images (that have sequential numbers in the file names) and tracks contours in them. It can export all or a subset of the contours in a .ts file as a .con file. It can save a palate trace, to superimpose on subsequent image files, as a .pal file. The exports are text files containing a series of coordinate points.
- When using this software for data analysis, please cite the published papers discussing the program: Li, M., Kambhamettu, C., and Stone, M. (2005) Automatic contour tracking in ultrasound images. Clinical Linguistics and Phonetics 19 (6-7); 545-554.

### **Usage:**

- Setting options:
  - The View menu allows you to toggle the snaxels, the images, the palate and the green interesting area box on and off.
  - The Configure->Optimization Parameters window allows you to reduce smoothness to increase image weight to better track the edges, or increase smoothness to give more weight to model if image is unclear. (image weight + smoothness model trade-off)
  - The Configure->Animation Speed menu allows you to play the sequence of images faster or slower.
- Tracking contours:
  - Select File->Load Images:
    - Click on "Get Sample."
    - Select any one of the jpg files in the sequence you want to use and click open.
    - Change the numbers at the end of the file (ex: 001) to ### in the file template field. (see screenshot in next page)
    - Type in start & end frame #'s (predetermined by user).
    - Click OK.



- Select Configure->Interesting Area and Scaling Marks:
  - Click anywhere in the green box to drag it and adjust its size by dragging the corners. If you click in the box without selecting “Configure,” you will select a point (red dot), which must be erased (right button).
  - Click “Next” and look at all images to make sure all edges are within the box. The play button works in this mode.
  - Click “Done.”
- Select Optimize->Image Gradients:
  - Click OK to optimize all frames.
- Select File->Init by Click:
  - With left mouse button, place 5-6 points along the *lower* edge of the surface (white line), from left to right.
  - Click “Done.”
- Select Optimize->Optimize One Frame to track the surface in the current frame:
  - You can keep editing the contour until you like the curve (see section 3).
- Select Optimize->Optimize Whole Sequence:

- Click OK to optimize all frames after the current one, based on the current one. The current frame must already be optimized.
  - This process can be stopped at any point if the tracking seems to be going badly, however, if it not too askew, the tracking sometimes improves later in the sequence.
  - You can keep editing the contours until you like the curves (see section 3).
- Editing contours:
  - To edit a single frame:
    - Use left button to add a single point.
    - Use right button to delete a single point.
    - Select Edit->Cut Contour:
      - Use the left mouse button to cut everything to the left of selected point.
      - Use the right mouse button to cut everything to the right of selected point.
      - Click “Done” when satisfied. If you don't click “Done,” the next time you click the left button to select a point, you will delete a section instead! There is a fast learning curve for this.
    - Then re-optimize the frame if you'd like, or leave frame as is for saving.
  - To edit a sequence:
    - Edit each frame as needed, and re-optimize a sub-sequence if it looks like the new shape carries through. A subset of frames may be optimized based on the immediately preceding one. So be sure to have the “good” contour active and the “start” frame as the next frame.
  - When all else fails:
    - Manually select good points and delete bad ones and save without optimizing. It doesn't matter if some contours are optimized and others are not.
- Exporting contours:
  - Select File->Save Ts File As:
    - You need at least 2 frames in a .ts file. If you only want one contour, copy and paste it onto the second image and save.
  - Select File->Export Contours:

- You need at least 2 frames in a .con file. If you only want one contour, copy and paste it onto the second image and save.
  - Insert scale constant, e.g. 0.295 (default). This number will convert pixels to mm. To find the best scale constant, use a program such as Image J, and left click two consecutive lines (1 cm) on the Ultrasound image scale. All ultrasound machines put a cm scale somewhere on the image. Note how many pixels are between the 2 lines (try to keep the x values fairly constant, and only subtract the y values). This will be the scaling factor to convert pixels to cm. Multiply by 10 and use this as the scale constant. The value needs to be calculated once for each depth setting used.
  - Enter the frame numbers whose contours you want to export.
  - Click OK.
- Managing palates:
    - Track the contour of the palate from a swallow at the point of maximum hyoid excursion if possible. Several frames should be observed to determine the best possible palate.
    - Select File->Save Current Contour as Palate for exporting a .pal file (in pixels) for future superimposition in EdgeTrak.
    - Select File->Load Palate for viewing an existing palate trace in EdgeTrak.

#### **File Formats:**

- The .ts file contains the four points in the “green box,” the path to the images, the numbers of the jpgs used, and the base set of points stored for each image (default = 50).
- The .con file is a text file that contains a set of xy coordinate points for each contour. These values are in mm and include interpolated points (default = 100), whose number is set by the user.