

Semantic-Aware Image Retargeting

Group 3

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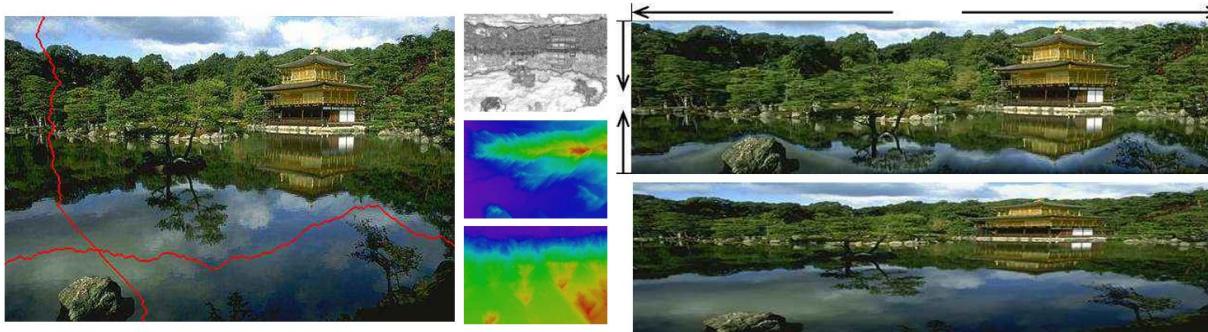


Figure 1: A seam is a connected path of low energy pixels in an image. On the left is the original image with one horizontal and one vertical seam. In the middle the energy function used in this example is shown (the magnitude of the gradient), along with the vertical and horizontal path maps used to calculate the seams. By automatically carving out seams to reduce image size, and inserting seams to extend it, we achieve content-aware resizing. The example on the top right shows our result of extending in one dimension and reducing in the other, compared to standard scaling on the bottom right.

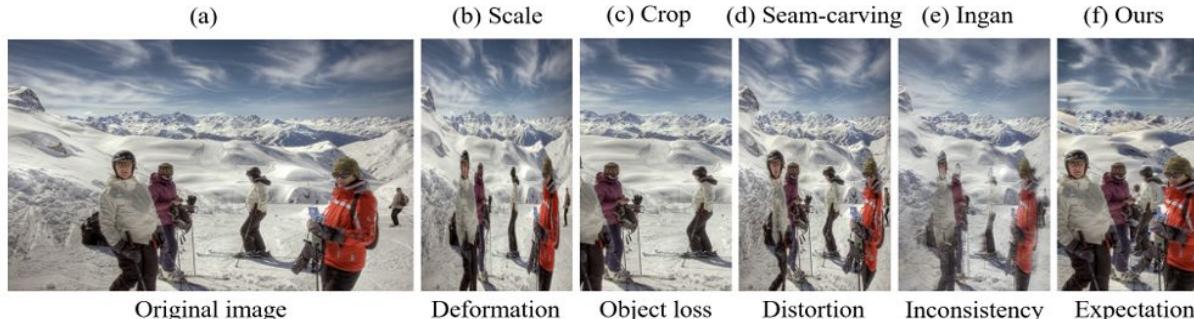


Figure 2: An example to show bad cases such as deformation, content loss, discontinuity in lines, inconsistent results and a good case

What is the objective?

Intelligently resize images to different aspect ratios while preserving important objects and structural elements

What is the input and output?

RGB image + target size → retargeted image with minimal artifacts.

What methods will you use?

- SAM-based object masks for multi-object importance maps
- Depth Anything for foreground/background layer separation
- Seam Carving: Forward energy with composite function (gradients + SAM saliency + depth). Penalize seams through salient objects, foreground regions, depth discontinuities
- Apply diffusion models (Stable diffusion + ControlNet) for adaptive repainting as done in [PruneRepaint](#) paper

Evaluation:

Dataset: RetargetMe benchmark (80 images)

Metric:

- Quantitative: Analogous to Saliency Discard Ratio (SDR) as defined in [PruneRepaint](#) paper which used saliency maps
- Qualitative: Crowdsourcing and LLM-based description comparison for qualitative semantic preservation

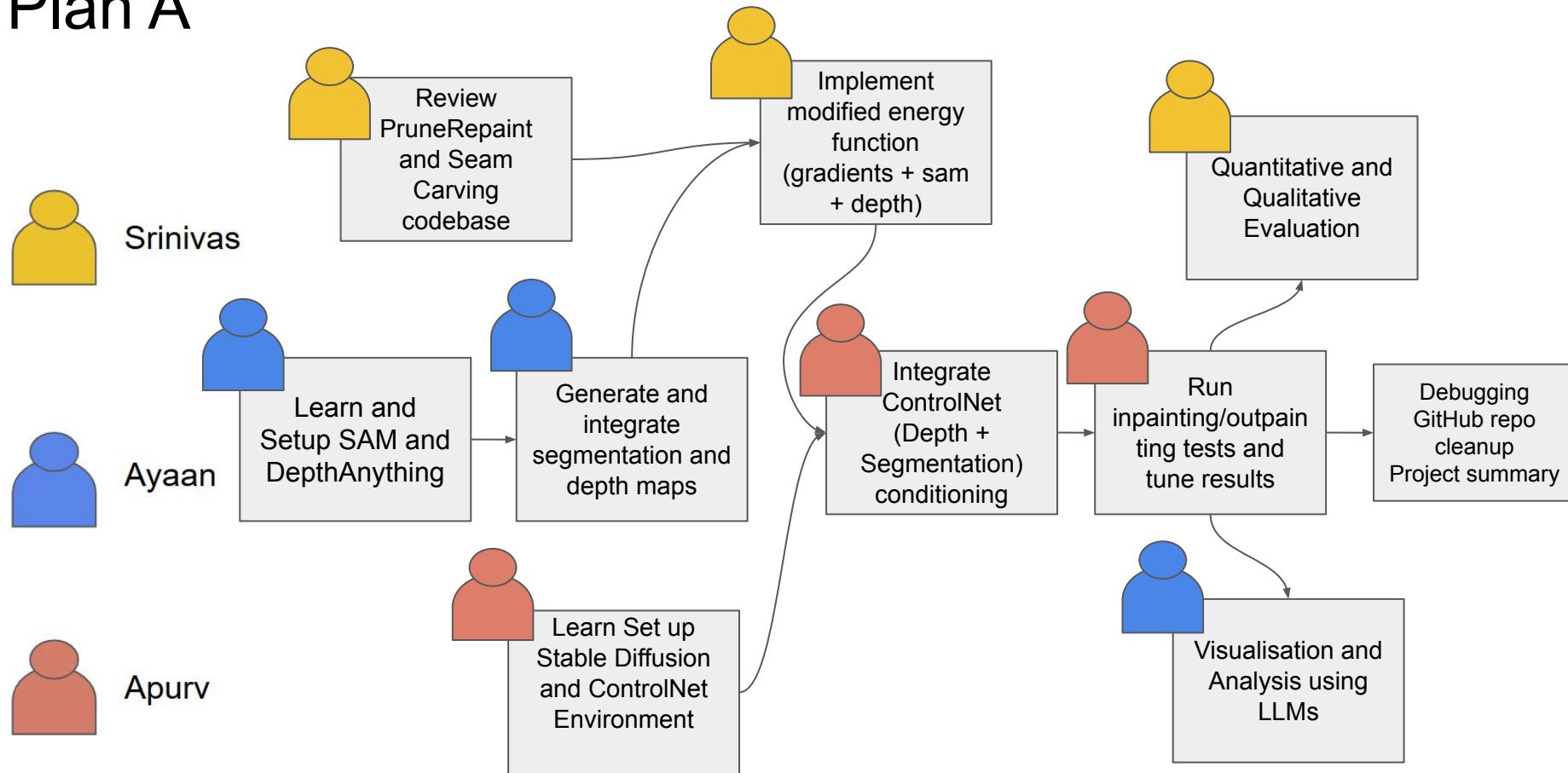
What is the learning outcome from this project?

- Gain hands-on experience integrating foundation models like Segment Anything, Depth Anything and generative models like stable diffusion into image processing pipelines
- Implement seam carving with custom energy functions from scratch

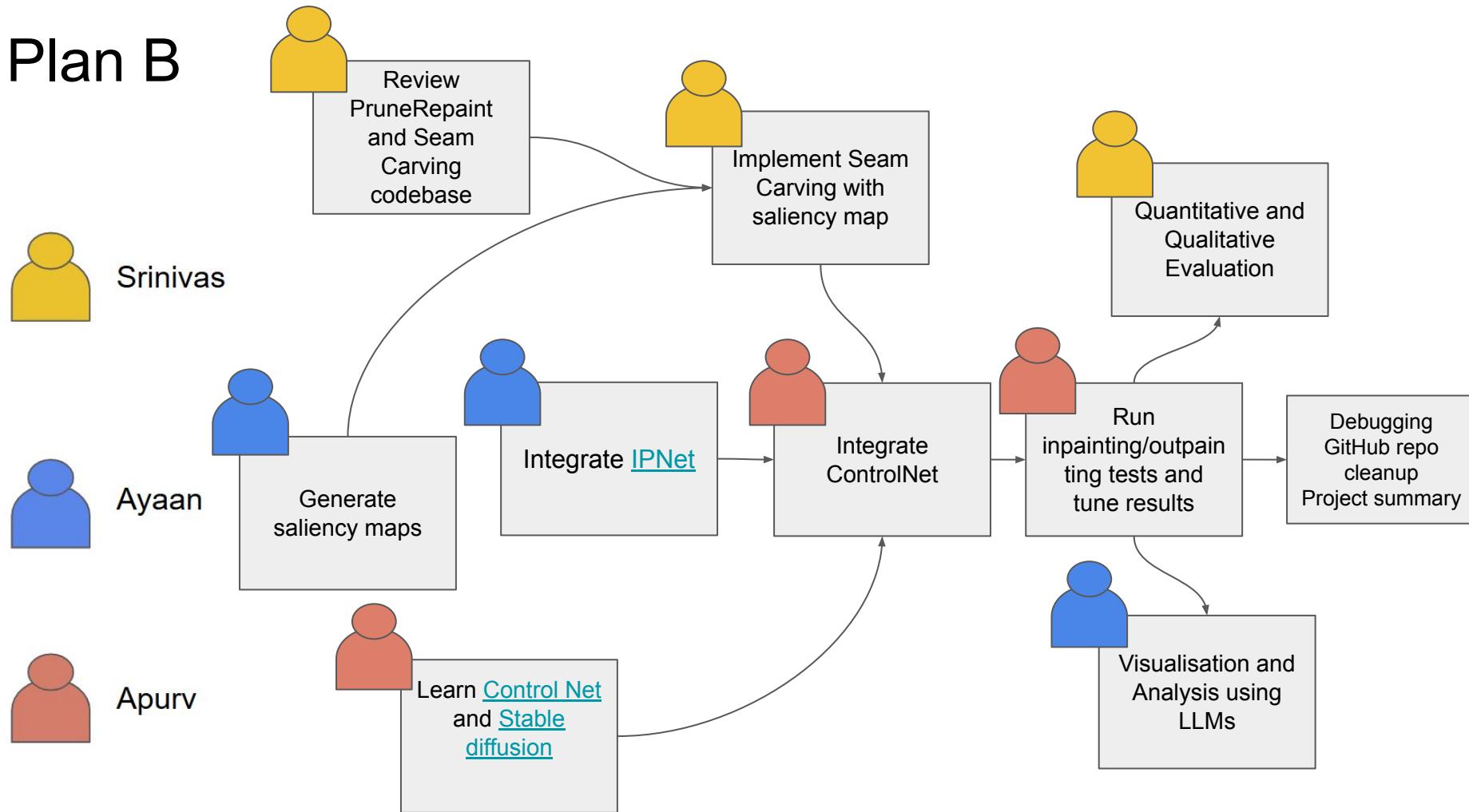
What will be a project deliverable?

Live demo during poster presentation and software repository

Plan A



Plan B



Tasks - members - timeline

	Week of 11/03	Week of 11/10	Week of 11/17	Week of 11/24
Srinivas	Review PruneRepaint codebase Baseline Seam Carving	Implement modified energy function (gradients + sam + depth)	Quantitative and Qualitative Evaluation	Debugging GitHub repo cleanup Project summary
Ayaan	Set up SAM and Depth Anything Models	Generate and integrate segmentation and depth maps	Visualisation and Analysis using LLMs	Debugging GitHub repo cleanup Project summary
Apurv	Set up Stable Diffusion and ControlNet Environment	Integrate ControlNet (Depth + Segmentation) conditioning	Run inpainting/outpainting tests and tune results	Debugging GitHub repo cleanup Project summary