Mobile Scanner

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Abstract:

In this report we are going to implement a mobile scanner which can be used for scanning text documents to produce output with decent resolution and clarity. Image alignment and stitching techniques commonly used in panoramic mosaic applications are adapted and combined with other image processing methods to stitch-together closely captured images of portions of a page. After initial pre-processing, the images are passed into an image-stitching pipeline which extracts and matches the features in the images and warps the images together. The application achieved a high level of resolution in the stitched output image.

Introduction:

When we urgently need to scan a document and we don't have a scanner around and if the document is large, we can use our phone to capture images of the document. In such a case we need to align the images and blend them to create a meaningful collage.
This project helps the user scan documents with the help of his mobile phone.The target is to make the output of the application as good, in quality, as that of a specialized scanner

Paper Implemented:

https://stacks.stanford.edu/file/druid:bf950qp8995/Badlani_Akinola_Li.pdf
This paper talks about how to send the image files into the stitch pipeline which applies various image processing techniques like feature detection, feature matching, image warping to rotate, translate, align and merge the capture portions into one single image.

Algorithm:

- Extract ORB/SURF features of images
- Match the features between each pair of images and estimate pairwise Homography matrices using RANSAC.
- Warp each image to global coordinate system.

Dataset:

We used our own dataset by capturing images by camera.

Observation:

Image1

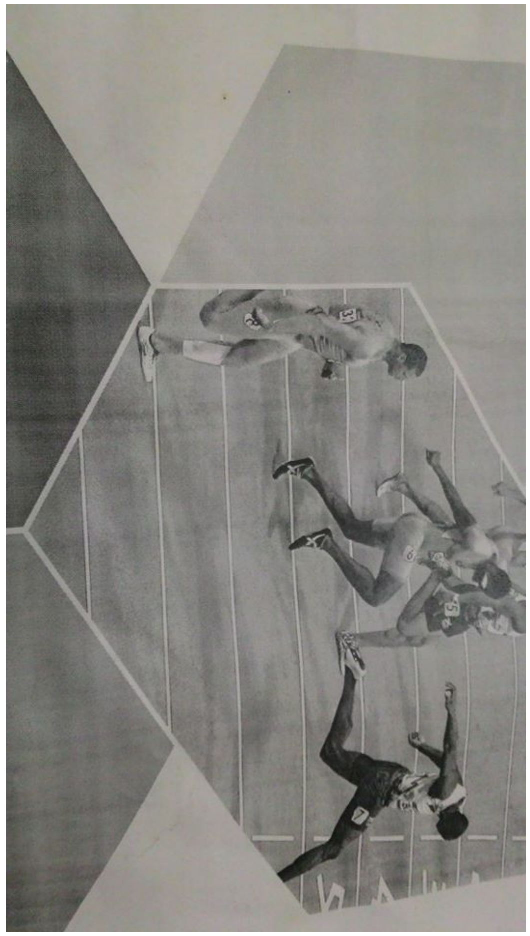


image2

Output

image1

image2

Output image

It is assumed that A and B have the same crystal structures in their pure states and can be mixed in any proportions to make a solid solution with the same crystal structure. Imagine that 1 mol of homogeneous solid solution is made by mixing together X_A mol of A and X_B mol of B. Since there is a total of 1 mol of solution

$$X_A + X_B = 1 \tag{1.18}$$

and X_A and X_B are the *mole fractions* of A and B respectively in the alloy. In order to calculate the free energy of the alloy, the mixing can be made in two steps (see Fig. 1.7). These are:

1. bring together X_A mol of pure A and X_B mol of pure B;
2. allow the A and B atoms to mix together to make a homogeneous solid solution.

After step 1 the free energy of the system is given by

$$G_1 = X_A G_A + X_B G_B \quad \text{J mol}^{-1} \tag{1.19}$$

where G_A and G_B are the molar free energies of pure A and pure B at the temperature and pressure of the above experiment. G_1 can be most conveniently represented on a *molar free energy diagram* (Fig. 1.8) in which molar free energy is plotted as a function of X_B or X_A. For all alloy compositions G_1 lies on the straight line between G_A and G_B.

The free energy of the system will not remain constant during the mixing of the A and B atoms and after step 2 the free energy of the solid solution G_2 can

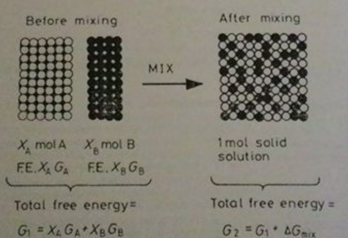
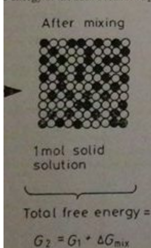


Fig. 1.7 Free energy of mixing.



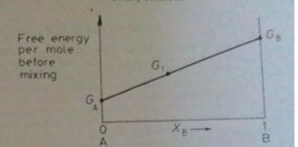


Fig. 1.8 Variation of G_1 (the free energy before mixing) with alloy composit[ion]
or X_B)

be expressed as

$$\boxed{G_2 = G_1 + \Delta G_{mix}}$$

where ΔG_{mix} is the change in Gibbs free energy caused by the mixi[ng]

Since

$$G_1 = H_1 - TS_1$$

and

$$G_2 = H_2 - TS_2$$

putting

$$\Delta H_{mix} = H_2 - H_1$$

and

$$\Delta S_{mix} = S_2 - S_1$$

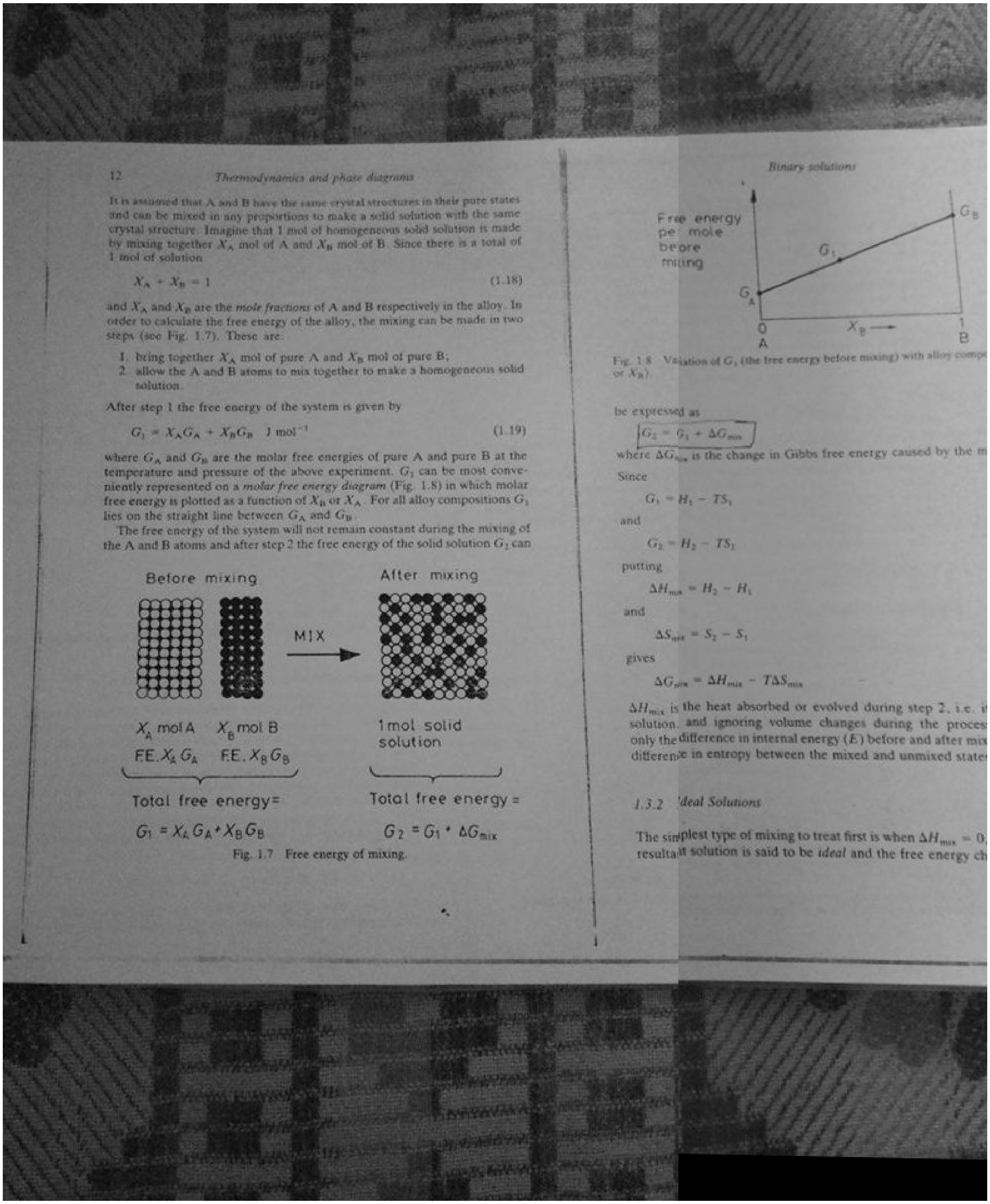
gives

$$\Delta G_{mix} = \Delta H_{mix} - T\Delta S_{mix}$$

ΔH_{mix} is the heat absorbed or evolved during step 2, i.e. it is
solution, and ignoring volume changes during the process, it
only the difference in internal energy (E) before and after mixing.
difference in entropy between the mixed and unmixed states.

1.3.2 Ideal Solutions

The simplest type of mixing to treat first is when $\Delta H_{mix} = 0$, in w
resultant solution is said to be *ideal* and the free energy change



Output image

As we can see in the observed image, we got decent output after warping the images together.

Conclusion:

We tried to implement this mobile scanner program using opencv. Though we tried to warp images together using ORB, it wasn’t giving satisfactory performance. so, we used SURF for feature detection. We achieved a good level of output. Many things are yet to be done like bundle adjustment and exposure compensation.