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$$C = \alpha F + (1-\alpha) B$$

C, F, B → C = pixel's composite; F = foreground colors; B = background colors

α → pixel's opacity component used to linearly blend both foreground, background.

$$\begin{bmatrix} \\ \\ \end{bmatrix}_{3\times1} = \alpha \begin{bmatrix} \\ \\ \end{bmatrix}_{3\times1} + (1-\alpha) \begin{bmatrix} \\ \\ \end{bmatrix}_{3\times1}$$

7 unknowns (alpha and three channel for F and B)

↳ 3 eq^ns (one per color channel)

⇓

Impossible to estimate F, B, α | C given

Therefore, we express this as a maximization over the probability distribution (P),

↳ $\arg\max_{F,B,\alpha} P(F, B, \alpha | C)$

Baye's Theorem:-

Likelihood: The probability of "B" being True, given "A" is True

Prior: The probability "A" being True. This is the knowledge

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

Posterior

The probability of "A" being True, given "B" is true

marginalization:-

The probability "B" being True

$$\arg\max_{F,B,\alpha} P(F,B,\alpha|C) = \arg\max_{F,B,\alpha} \frac{P(C|F,B,\alpha)P(F)P(B)P(\alpha)}{P(C)}$$

$$= \arg\max_{F,B,\alpha} L(C|F,B,\alpha) + L(F) + L(B) + L(\alpha)$$

~~[illegible]~~ we have to define these log likelihood terms
Now using gaussian model, how,

$$L(C|F,B,\alpha) = -\frac{\|C - \alpha F - (1-\alpha)B\|^2}{\sigma_C^2}$$

this log likelihood ~~error~~ shows error in measurement of C with gaussian probability distribution

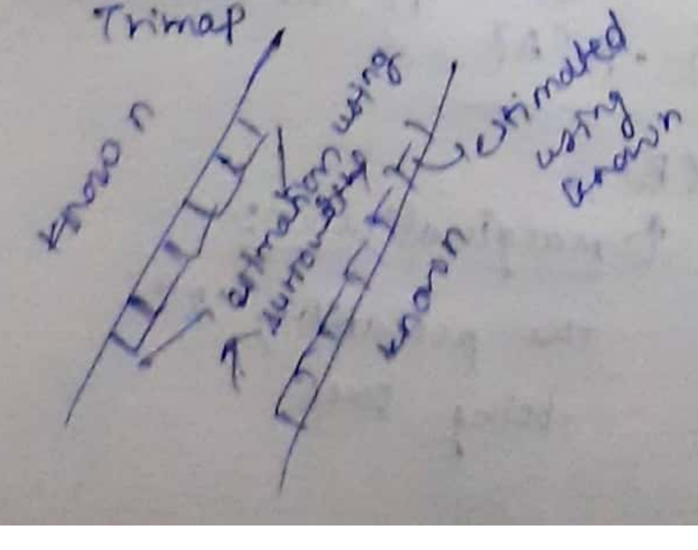
where,

$$\boxed{\begin{aligned} \bar{C} &= \alpha F + (1-\alpha)B \\ \bar{\sigma}_C &= \end{aligned}}$$

foreground.

$L(F)$ → we have to estimate spatial coherence of image to estimate foreground term $L(F)$. We find colour distribution by using the known and also the previously predicted / estimated within N pixels neighbourhood.

Trimap



1) To robustly model

first) we weight all the pixels by α_i^2 which gives advantage to the opaque pixels of higher confidence

second) $g_i \longrightarrow \sigma = 8$ to stress contribution of nearby pixels over those that are further away

Hence total weight $w_i = \alpha_i^2 g_i$

For given foreground colors and the known weights $(\alpha_i^2 g_i) \rightarrow w_i$

→ we partition colors into several cluster (for clustering we use orchard Bouman)

For each such cluster we calculate,

$\bar{F}$ and Σ_F

$$\bar{F} = \frac{1}{W} \sum_{i \in N} w_i F_i \quad \ldots \left(W = \sum w_i = \sum \alpha_i^2 g_i \right)$$

$$\Sigma_F = \frac{1}{W} \sum_{i \in N} w_i (F_i - \bar{F})(F_i - \bar{F})^T$$

so,
$$L(F) = \frac{-(F-\bar{F})^T \Sigma_F^{-1} (F-\bar{F})}{2}$$

Now for the $L(B) \longrightarrow$ Background.

Analogous to the foreground, $w_i = (1-\alpha_i)^2 g_i$

$$L(B) = \frac{-(B-\bar{B})^T \Sigma_B^{-1} (B-\bar{B})}{2}$$

Scanned with CamScanner

$L(\alpha) \rightarrow$ constant

$\underset{F,B,\alpha}{\arg\max}\, L(C|F,B,\alpha) + L(F) + L(B) + L(\alpha) = \underset{F,B,\alpha}{\arg\max}\, P(F,B,\alpha|C)$

$L(C|F,B,\alpha)$ ✓

$L(B)$ ✓ $\quad$ $L(F)$ ✓ $\rightarrow$ ① sub problem, ② sub problem

↑ to solve the eqn easily

$L(\alpha)$

① → assumption that α is constant.

subproblem | take partial derivatives of eqn with respect to F and B and set them equal to 0

$$\begin{bmatrix} \Sigma_F^{-1} + \frac{I\alpha^2}{\sigma_C^2} & \frac{I\alpha(1-\alpha)}{\sigma_C^2} \\ \frac{I\alpha^2 \sigma_C^2}{1-\alpha} & \Sigma_B^{-1} + \frac{I(1-\alpha)^2}{\sigma_C} \end{bmatrix} \begin{bmatrix} F \\ B \end{bmatrix} = \begin{bmatrix} \Sigma_F^{-1}\bar{F} + \frac{C\alpha}{\sigma_C^2} \\ \Sigma_B^{-1}\bar{B} + \frac{C(1-\alpha)}{\sigma_C^2} \end{bmatrix}$$

$\Sigma \rightarrow 3\times3$ matrix

↳ we can find best alpha for eq^n below by solving 6×6 linear eq^n

$$\begin{bmatrix} \Sigma_F^{-1} + I\alpha^2/\sigma_C^2 & \dfrac{I\alpha(1-\alpha)}{\sigma_C^2} \\ \dfrac{I\alpha(1-\alpha)}{\sigma_C^2} & \Sigma_B^{-1} + \dfrac{I(1-\alpha)^2}{\sigma_C^2} \end{bmatrix} \begin{bmatrix} F \\ B \end{bmatrix} = \begin{bmatrix} \Sigma_F^{-1}\bar{F} + \dfrac{C\alpha}{\sigma_C^2} \\ \Sigma_B^{-1}\bar{B} + \dfrac{C(1-\alpha)}{\sigma_C^2} \end{bmatrix}$$

② second problem we assume that F and B are constant.

observing colour C ; onto the line segment FB in color space;

$$\alpha = \frac{(C-B)(F-B)}{\|F-B\|^2}$$

Pseudo Algorithm on lines of which code is analysed and written

① set foreground and background pixels α accordingly
⇓
calculate the unknown and known, trimap, real map. The white color in trimap is a 100% real and the black color in trimap is 100% real.
The confusion where there is grey scale in market.

② for all pixel p marked as unknown in Mdo
cluster foreground and background colours in $p(s')$ neighbourhood.

↳ using clustering algorithm here, foreground and background cluster pairs do.

③ for all foreground - background cluster pairs
solve for the best F, B, α | C using alternative option
calculating result likelihood.

④ end for
maximal likelihood have achieved to F(p), B(p), α(P)
mark p as known

return F, B, α

Algo Bayes - Matting (C, M)

1. set foreground and background pixels in α according to M
2. for all pixels p marked in M do c F, B images (colors in p's headdown)
   cluster ~~for~~ ~~FgBC~~

   for all ~~foreground-Background~~ background

   folders cruit

   end for

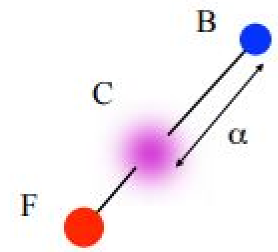
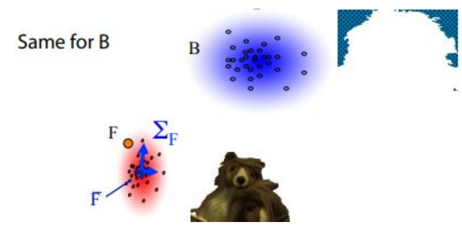
assignment 4, 5, 6 silicon valley apne hisab se bna hain ha?

   assign to F(P), B(P), α(P) results achieved maximal likelihood.

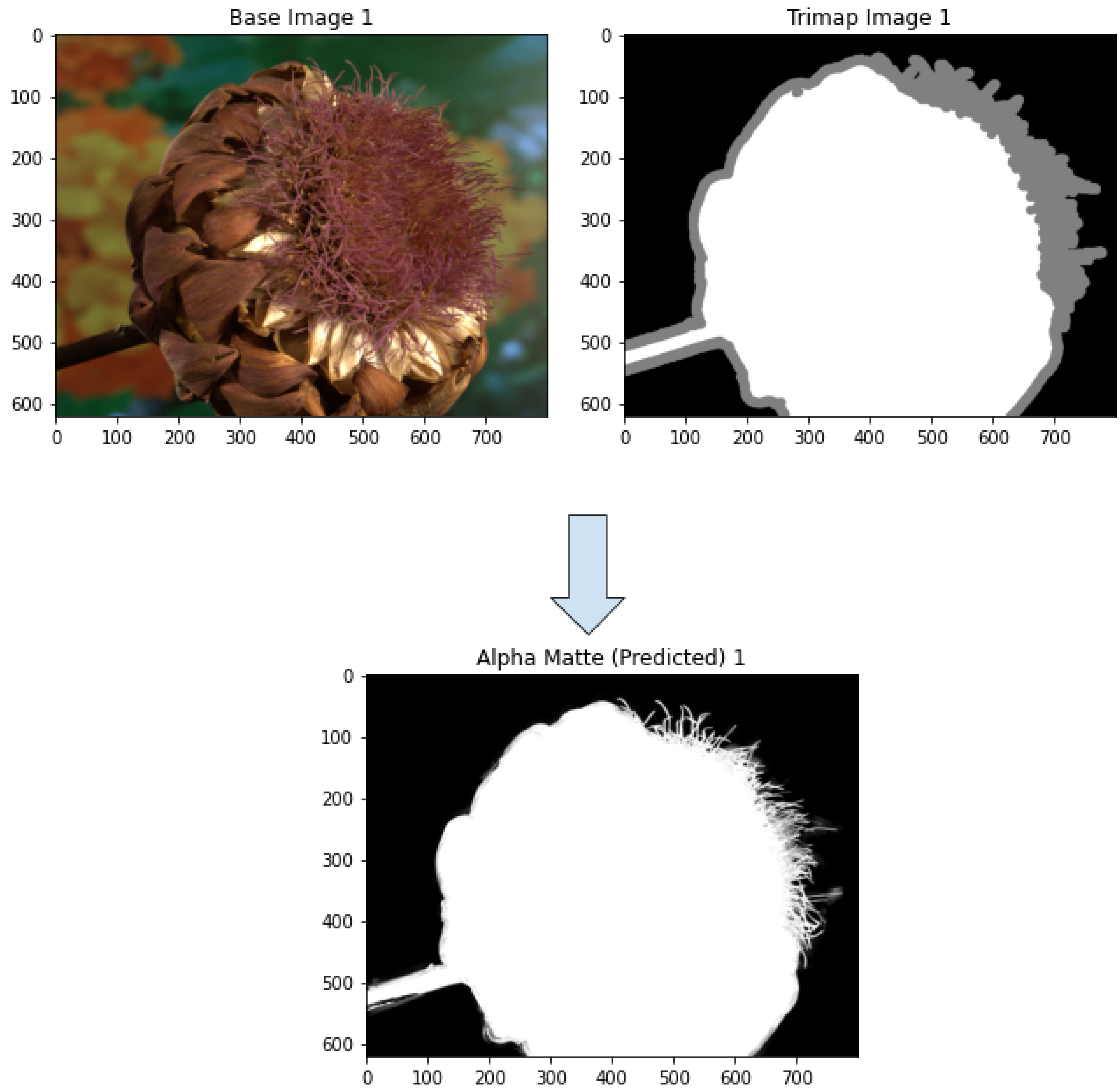
   mark p as know

end for

return F, B, α

L(C|F,B,α)	$- \|\|C - \alpha F - (1-\alpha) B\|\|^2 / \sigma^2_C$	
L(F)	$\bar{F} = \frac{1}{N_F}\sum F_i$ $\Sigma_F = \frac{1}{N_F}\sum(F_i - \bar{F})(F_i - \bar{F})^T$ $L(F) = -(F - \bar{F})^T \Sigma_F^{-1}(F - \bar{F})/2$	
L(B)	Similar for the B	Similar for the B

Some of the Results :



Alpha Matte (Predicted)	True Matte