LIST OF SYMBOLS

$c(u,v)$	Capacity of edge (u,v)
$f(u,v)$	Value of flow f from vertex u to vertex v or in other words, flow through edge (u,v)
s	Source of the network flow
t	Sink of the network flow
$\{S,T\}$	Partition of the set V of vertices of network flow in to two disjoint sets S and T, where S contains source and T contains sink and $S \cup T = V$
$\|f\|$	Value of the flow f, which is defined as $\|f\| = \sum_{v \in V} f(s,v)$, i.e. sum of flows of all edges connected with the source
$\|e\|$	Cost associated with the edge e.
G_f	The *residual network* of $G=(V,E)$ induced by the flow f, i.e, $G_f = (V, E_f)$
V	1. The set of all vertices in a graph G. 2. The set of all pixels of given image
E	The set of all edges of graph G
Ω	The set of all possible labels $\{\sigma_1, \sigma_2, ..., \sigma_p\}$ of image pixels
X	A labeling of the image is a function $X : V \rightarrow \Omega$
x_v , $X(v)$	The label assigned to pixel v by the labeling $X : V \rightarrow \Omega$
$O(X)$	Value assigned to a labeling X by objective function O, where objective function O is defined as $O(X) = \sum_{v \in V} \varphi_v(x_v) + \sum_{\{v,w\} \in N} \psi_{v,w}(x_v, x_w)$
$O_{data}(X)$	Data component of objective function O, typically defined as $O_{data}(X) = \sum_{v \in V} \varphi_v(x_v)$
φ_v	Function from X(v) = $\{x_v \mid x_v \in \Omega\}$ to the set of real numbers which measures how unsuitable is label x_v for pixel v with reference to data constraint
$\psi_{v,w}$	Neighbor relation function $\psi_{v,w}(x_v, x_w)$ allot penalty to assignment of pair of pixels x_v and x_w to the pair of neighboring pixels v and w. It fosters the neighboring pixels v and w to have same or similar labels. $\psi_{v,w}(x_v, x_w)$ can be defined in numerous

different ways. One way to define it is $|x_v - x_w|$

N_v The set of all neighbors of pixel *v*

N The set of all neighboring vertices/pixels of the graph/image.

$P(X / X')$ Conditional probability of *X* given *X'*

$e_v^{\sigma_1}$ Terminal edge connecting vertex *v* to σ_1

$e_{v_1 v_2}^n$ Non-terminal edge connecting pair of vertices v_1 and v_2

X_C Labeling corresponding to cut *C*

$\arg\max_{X \in F}$ Value of $X \in F$, for which the value of the function under consideration is maximized.

{ } Empty set (also denoted by ϕ)

$I(x_v, x_w)$ A component function of $\psi_{v,w}(x_v, x_w)$ (in case of segment-wise constant structure) which is defined as $I(x_v, x_w) = \begin{cases} 0, & \text{if } |x_v - x_w| = 0 \\ 1, & \text{otherwise} \end{cases}$, where $\psi_{v,w}(x_v, x_w) = c_{vw}\ I(x_v, x_w)$

p_{uv} penalty imposed by the objective function O to *X* for assigning different binary values X_u and X_v to the neighboring pixels *u* and *v*. It is defined by $p_{uv} = |X_u - X_v|$

g_v Grey value of pixel $v \in V$

t' Binary label representing text

b Binary label representing background.

O^2 The class of all objective functions that can be represented as sum of terms involving clique of size at most two. Objective function members *O* of this class are expressed as $O(y_1, y_2, \ldots\ldots, y_n) = \sum_{i=1}^{n} O_i(y_i) + \sum_{1<i<j<n} O_{ij}(y_i, y_j)$

O^3 The class of all objective functions that can be represented as sum of terms involving clique of size at most three. Objective function members *O* of this class are expressed as

$$O(y_1, y_2, \ldots, y_n) = \sum_{i=1}^{n} O_i(y_i) + \sum_{1<i<j<n} O_{ij}(y_i, y_j) + \sum_{1<i<j<k<n} O_{ijk}(y_i, y_j, y_k)$$

O_i Component objective function assigning value $O_i(y_i)$ to y_i,

$\hat{\mathrm{O}}$ The set of all objective functions of variables $y_1, \ldots, y_n$ of range of size two

θ Real-valued function defined on $\hat{\mathrm{O}}$, defined as $\theta(O) = \sum_{\substack{y_i' \in \{\alpha, \beta\} \\ 1 \le i \le n}} \gamma(y_1', y_2', \ldots, y_n') O(y_1', y_2', \ldots, y_n'), \forall O \in \hat{\mathrm{O}}$

γ Real valued function defined on the set of all possible configurations of n variables and is defined as

$\gamma(y_1', y_2', \ldots, y_n') = \begin{cases} -1, \text{if } (n_2, 2) = 1 \\ 1, \text{otherwise} \end{cases}$ for configuration $y_1', y_2', \ldots, y_n'$ with $\sum_{i=1}^{n} y_i' = n_1\alpha + n_2\beta \left(n_1, n_2 \in \mathbb{Z}^+\right)$

(n,m) Greatest common divisor of n and m. If $(n,m) = 1$, then n and m are called relatively prime.

$proj[\mathrm{O}(y_1 = y_1', \ldots, y_k = y_k')]$ Projection of O on $y_1 = y_1', y_2 = y_2' \ldots, y_k = y_k'$, defined as, $proj[\mathrm{O}(y_1 = y_1', y_2 = y_2' \ldots, y_k = y_k')] = O\left(y_1', \ldots, y_k', y_{n-k+1}, \ldots y_n\right)$,

where $y_1', \ldots, y_k' \in \{\alpha, \beta\}$ are some fixed values.