Algorithm 1 Fused Sampling Technique via Joint Multi-Criteria Sampling

Require: D (data), N (number of data points), M (number of samples), B (number of bins)
Ensure: I_F (importance function/histogram for selecting M samples from N data points)

$H \leftarrow histogram(D, N, B)$
$H \leftarrow sortascending(H)$
$I_F \leftarrow zeros(B^2)$
$C \leftarrow M/B$ ▷ Expected number of samples
$j = 0$
while $j < B$ **do**
  $c \leftarrow H[j]$ ▷ Count in j^{th} bin
  if $c_j < C$ **then** ▷ Case 1: Bin did not have sufficient data to sample
    $G_j \leftarrow computeGradient$(Points in j^th Bin)
    $G_j^{mag} \leftarrow computeGradientMagnitude(G_j)$
    $H_j \leftarrow histogram(G_i^{mag}, c_j, B)$
    $C_j \leftarrow c_j/B$
    $i = B - 1$
    while $i \geq 0$ and $c_j > 0$ **do** ▷ Smoothness Based sampling in j^{th} bin
      $c_{ji} \leftarrow H_j[i]$
      $I_F[B.j + i] = c_{ji}$
      $c_j = c_j - c_{ji}$
      $i = i - 1$
    end while
    $M \leftarrow M - c_j$
    $B \leftarrow B - 1$
    $C \leftarrow M/B$
    $j = j + 1$
  else ▷ Case 2: Bin has sufficient data to sample
    for $k \leftarrow j$ to B **do**
      $G_k \leftarrow computeGradient$(Points in k^th Bin)
      $G_k^{mag} \leftarrow computeGradientMagnitude(G_k)$
      $H_k \leftarrow histogram(G_k^{mag}, c_k, B)$
      $C_k \leftarrow c_k/B$
      $i = B - 1$
      while $i \geq 0$ and $c_k > 0$ **do** ▷ Smoothness Based sampling in all the remaining bins
        $c_{ki} \leftarrow H_k[i]$
        $I_F[B.k + i] = c_{ki}$
        $c_k = c_k - c_{ki}$
        $i = i - 1$
      end while
    end for
  end if
end while
for $j \leftarrow 1$ to B **do** ▷ Normalization of Importance function
  for $i \leftarrow 1$ B **do**
    $I_F[B.j + i] \leftarrow I_F[B.j + i]/H_j$
  end for
end for