VI-Trajectory to Binary Image algorithm is based on the following instructions:

In order to effectively handle the difference between V–I trajectories of PELs within the same category, this paper proposes to first map the V–I trajectory to a grid of cells. Each cell is assigned a binary number. If the V–I trajectory cross though a cell, this cell is occupied by this V–I trajectory, assigned 1, and shown as a solid block as shown in Fig. 2.

The binary mapping algorithm is defined as follows:

1) Load Voltage and Current Waveforms:

Assume that there are a total of K data points of the form (v_k, i_k), where $k = 1,...,K$. Also, v_k and i_k are the voltage and current values of data point k, respectively.

2) Calculate

$$v_{max} = \max v_k, \quad v_{min} = \min v_k$$
$$i_{max} = \max i_k, \quad i_{min} = \min i_k$$
$$v_0 = \frac{1}{2}(v_{max} + v_{min}), \quad \text{and} \quad i_0 = \frac{1}{2}(i_{max} + i_{min}). \quad (1)$$

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3) Read input N, which defines the size of the grid in the horizontal direction.

4) Calculate

$$\Delta v = \frac{v_{max} - v_0}{N}, \quad \Delta i = \frac{i_{max} - i_0}{N} \qquad (2)$$

and generate two sequences,

$$\{v_0 - N \cdot \Delta v, \ldots, v_0 - \Delta v, v_0 + \Delta v, \ldots, v_0 + N \cdot \Delta v\}$$

and

$$\{i_0 - N \cdot \Delta i, \ldots, i_0 - \Delta i, i_0 + \Delta i, \ldots, i_0 + N \cdot \Delta i\}$$

which both have 2N elements.

5) Define a 2N x 2N grid. Cell (xth, yth) is assigned a positional value

$(v0 + \Delta v \cdot (x-N), i0 + \Delta i \cdot (y-N))$,

and a binary model value $B_{x,y}$ which is initialized to be 0.

6) Load half-cycle of data points, starting from the zero-crossing point from negative to positive to another zero-crossing point from positive to negative.

7) Start with the first data point $(v_1{}^h, i_1{}^h)$ of the data points loaded in 6, and execute the following loop:

$$
\begin{aligned}
&\textbf{for } \text{every cell } (N+1, y),\ y = N+1, N+2, \ldots, 2N \\
&\quad \textbf{if } (v_1^h - v_0) < \tfrac{\Delta v}{2} \text{ and } (i_1^h - (i_0 + (y - N) \cdot \Delta i)) < \tfrac{\Delta i}{2} \\
&\quad\quad \text{cell } (N+1, y) \text{ is occupied and } B_{\Delta+1,y} = 1; \\
&\quad\quad \text{cell } (N+1, y) \text{ is stored as the } \underline{\textit{winner}} \text{ of}(v_1^h, i_1^h); \\
&\quad\quad \textbf{break}; \\
&\quad \textbf{end} \\
&\textbf{end}
\end{aligned}
$$

8) For the remaining data points from 6, repeat 7 by searching the eight adjacent cells of the previous winner

9) Repeat 7 for a predefined number of times