Algorithm 1 Nonparametric tensor completion

Input: Noisy and incomplete data tensor $\mathcal{Y}_\Omega$, rank r, resolution parameter H.

1: **for** $\pi \in \mathcal{H} = \{-1, \ldots, -\frac{1}{H}, 0, \frac{1}{H}, \ldots, 1\}$ **do**

2: Define π-shifted tensor $\bar{\mathcal{Y}} = \mathcal{Y} - \pi$ and corresponding sign tensor $\mathrm{sgn}(\bar{\mathcal{Y}}) = \mathrm{sgn}(\mathcal{Y} - \pi)$.

3: Run 1-bit tensor estimation using base algorithm (e.g (**????**)) on $\bar{\mathcal{Y}}_\Omega$ and obtain $\hat{\mathcal{Z}}_\pi \leftarrow \arg\min_{\text{low-rank } \mathcal{Z}} \sum_{\omega \in \Omega} |\bar{\mathcal{Y}}(\omega)| \times F(\mathcal{Z}(\omega)\mathrm{sgn}\bar{\mathcal{Y}}(\omega))$ where $F(\cdot)$ is the large-margin loss.

4: **end for**

Output: Estimated signal tensor $\hat{\Theta} = \frac{1}{2H+1} \sum_{\pi \in \mathcal{H}} \mathrm{sgn}(\hat{\mathcal{Z}}_\pi)$.