Appendix

HM-ANN Graph Search Algorithm Algorithm 3 depicts the search algorithm in HM-ANN. The search begins at the entry point in the top layer (Line 1 in Algorithm 3) and then performs a one-greedy search from the layer i ($i > 2$) to the layer 2 (Lines 4 to 6 in Algorithm 3). To obtain high quality search, HM-ANN performs beam search in L1 and L0 with search budget length $efSearch_{L1}$ (Line 7 in Algorithm 3) and $efSearch_{L0}$ (Line 8 in Algorithm 3) respectively. Different from searching in the upper layers, HM-ANN uses multiple entry points in L0. The number of entry points in L0 equals to $efSearch_{L1}$.

Algorithm 3: HM-ANN K-NN-Search

Input: multi-layer graph HM-ANN, query element q, number of nearest neighbour to return K
Output: K nearest elements to q
Parameters : size of the dynamic candidate list in layer 1 and 0 as $efSearch_{l1}$ and $efSearch_{l0}$ respectively

1 $ep \leftarrow$ entry point of HM-ANN;
2 $L \leftarrow$ level of ep ;
3 $W \leftarrow \varnothing$;
4 **for** $i \leftarrow L...2$ **do**
5 $\quad W \leftarrow$ search_layer($q, \{ep\}, ef = 1, i$);
6 $\quad ep \leftarrow$ get nearest element from W to q;
7 $W \leftarrow$ search_layer($q, \{ep\}, efSearch_{l1}, 1$);
8 $W \leftarrow$ search_layer($q, W, efSearch_{l0}, 0$);
9 **return** K nearest elements from W to q