A Consistent Diffusion-Based Algorithm for Semi-Supervised Classification on Graphs

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1 Appendix: Proof of Lemma 1

Proof. In view of (2), we have:

$$(n_1(p-q) + nq)T_1 = s_1 p + (n_1 - s_1)pT_1 + \sum_{j \neq 1}(n_j - s_j)qT_j,$$

$$(n_k(p-q) + nq)T_k = s_1 q + (n_k - s_k)pT_k + \sum_{j \neq k}(n_j - s_j)qT_j, \quad k = 2, \ldots, K.$$

We deduce:

$$(s_1(p-q) + nq)T_1 = s_1 p + Vq,$$
$$(s_k(p-q) + nq)T_k = s_1 q + Vq \qquad k = 2, \ldots, K.$$

with

$$V = \sum_{j=1}^{K}(n_j - s_j)T_j.$$

The proof then follows from the fact that

$$n\bar{T} = s_1 + \sum_{j=1}^{K}(n_j - s_j)T_j = s_1 + V.$$

$\square$