



















测精度的影响,实验用 WS-Dream 数据集分别在响应时间和吞吐量两个属性上,在矩阵密度为 0.05, $\lambda=0.4$ ,设置 Top- $k$  值为从 1~6 并以 1 的间隔逐渐增加对 MAE 和 RMSE 的影响,结果如图 7 所示。

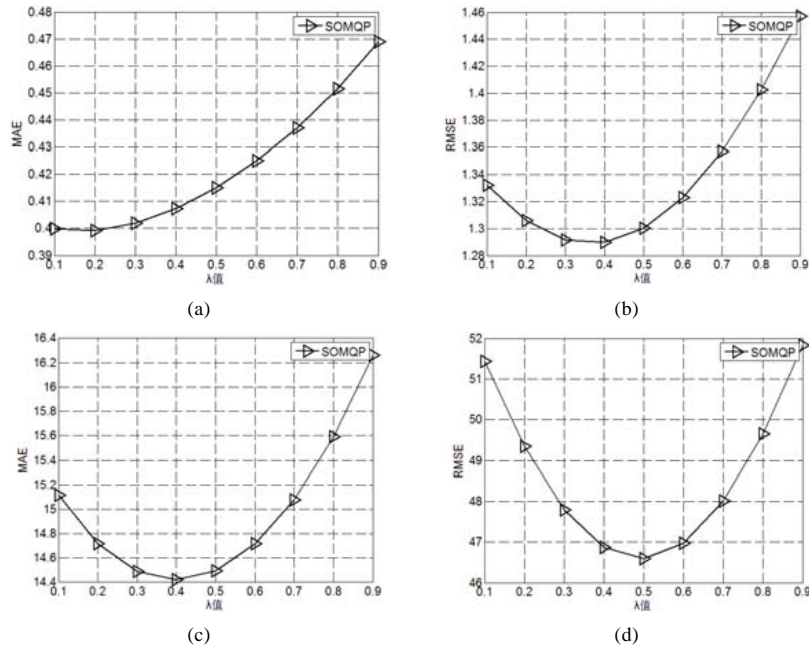


Fig.6 Impact of  $\lambda$  on prediction accuracy

图 6  $\lambda$  对预测精度的影响

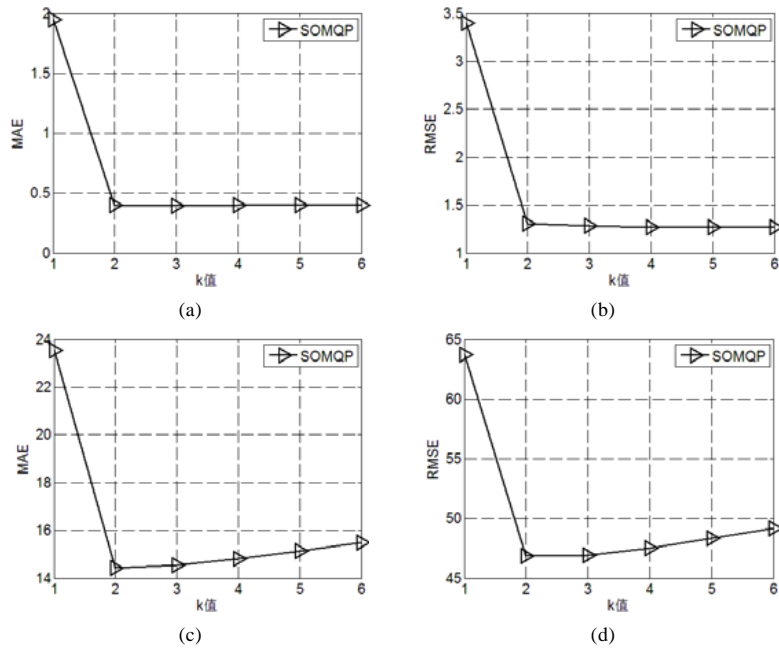


Fig.7 Impact of Top- $k$  on prediction accuracy

图 7 Top- $k$  对预测精度的影响

其中,图 7(a)、图 7(b)是在响应时间的实验结果,图 7(c)、图 7(d)是在吞吐量上的实验结果.从图 7(a)、图 7(c)可以看出,随着  $k$  值的增加,预测精度先变大然后变小,并在  $k$  为 2 时达到最大.这说明相似用户或相似服务数越多,并不一定有利于提高预测精度.相似用户数和相似服务数过少或过多,都会降低预测精度:如果相似用户数太少,不能全面考虑用户之间的关系;如果相似用户数太多,则不能排除那些对服务进行恶意评价的用户,这些恶意评价的用户会对预测精度有很大的影响.同样地,相似服务数越多,那些被用户恶意评价的服务信息会大大降低预测精度.

### (3) 矩阵密度的影响

矩阵密度表示从用户-服务矩阵中移出作为训练集的数据比例.图 8 是在 WS-Dream 数据集上,分别对响应时间和吞吐量两个 QoS 属性研究矩阵密度的影响.设置矩阵密度从 0.05 到 0.25,以 0.05 的间隔增加, $\lambda=0.4$ ,相似用户数和相似服务数为 2.

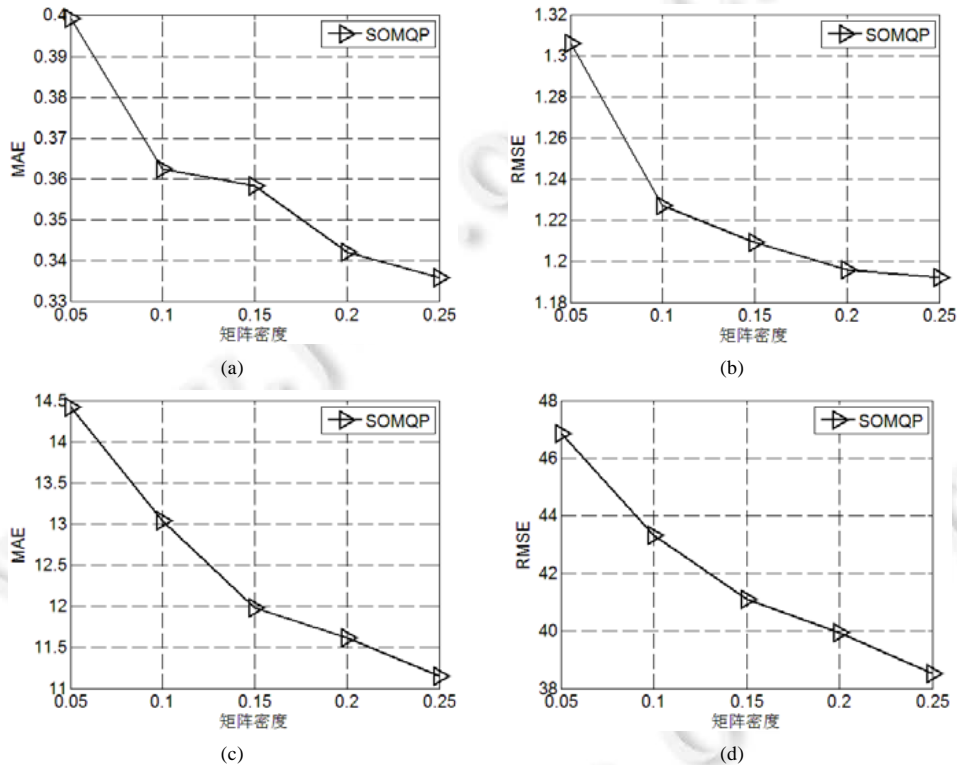


Fig.8 Impact of matrix density on prediction accuracy

图 8 矩阵密度对预测精度的影响

从图 8 可以看出,随着矩阵密度的增加,SOMQP 方法的服务质量预测精度也逐步提高.这是因为矩阵密度越大,说明更多的用户调用过更多的服务,所产生的数据集中包含更多的用户信息和服务信息,可以从这些信息中挖掘更多有用信息来提高预测精度.

## 4 结束语

本文提出一种基于 SOM 神经网络的服务质量预测方法 SOMQP.首先根据历史 QoS 数据,用 SOM 分别对用户和服务进行聚类,得到用户关系矩阵和服务关系矩阵;然后,基于一种新的 Top- $k$  选择机制,获得目标用户和目标服务的相似用户集和相似服务集;最后,结合基于相似用户的和基于相似服务的方法,提出一个混合策略对

缺失 QoS 值进行预测.在真实数据集上的实验结果表明,与经典的 CF 算法、基于改进的 PCC 预测算法和 K-means 聚类算法相比,我们方法的质量预测精度分别提高了 34.9%、29.5%和 4.3%.随着服务规模的增大,用户-服务信息矩阵也变得越来越,在接下来的研究中,将在 Spark 平台使用并行聚类技术来验证本文算法的有效性和稳定性.

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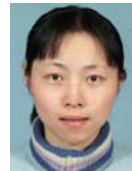
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#### 附中文参考文献:

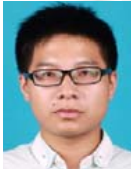
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张以文(1976—),男,安徽马鞍山人,博士,副教授,CCF 专业会员,主要研究领域为服务计算,云计算,大数据.



贾兆红(1976—),女,博士,副教授,CCF 专业会员,主要研究领域为多目标优化算法,组合优化.



项涛(1989—),男,硕士,主要研究领域为服务推荐.



何强(1982—),男,博士,高级讲师,博士生导师,主要研究领域为面向服务的软件工程,大数据.



郭星(1983—),男,博士,讲师,CCF 专业会员,主要研究领域为服务计算,智能算法.