Distance metric learning (DML) is an important technique to improve similarity search in content-based image retrieval. Despite being studied extensively, most existing DML approaches typically adopt a single-modal learning framework that learns the distance metric on either a single feature type or a combined feature space where multiple types of features are simply concatenated. Such single-modal DML methods suffer from some critical limitations: (i) some type of features may significantly dominate the others in the DML task due to diverse feature representations; and (ii) learning a distance metric on the combined high-dimensional feature space can be extremely time-consuming using the naive feature concatenation approach. To address these limitations, in this paper, we investigate a novel scheme of online multi-modal distance metric learning (OMDML), which explores a unified two-level online learning scheme: (i) it learns to optimize a distance metric on each individual feature space; and (ii) then it learns to find the optimal combination of diverse types of features. To further reduce the expensive cost of DML on high-dimensional feature space, we propose a low-rank OMDML algorithm which not only significantly reduces the computational cost but also retains highly competing or even better learning accuracy. We conduct extensive experiments to evaluate the performance of the proposed algorithms for multi-modal image retrieval, in which encouraging results validate the effectiveness of the proposed technique.