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SECURE TENSOR DECOMPOSITION FOR HETEROGENEOUS ULTIMEDIA DATA IN CLOUD COMPUTING

ABSTRACT

With the rapid development and proliferation of multimedia systems and applications, there is a growing need to handle multimedia heterogeneous data safely and efficiently on the cloud. Tensor models are effective in representing multimedia multidimensional data, and the tensor decomposition is one of the basic building blocks of data analysis and learning models. In this project propose, secure tensor singular value decomposition (*S*-tSVD), in which the time domain operation is converted into a scheme featuring frequency domain multilinear circular unfolding folding. First, we represent various multimedia data as cipher sub tensors, using fully homomorphic encryption. We then take the fast Fourier transform (FFT) approach to launch a new multiplication operation along the tubal fibers of a unified high order tensor. Second, relying on the homomorphism of addition and multiplication theory, we prove the fully homomorphic consistency of the proposed *S*-tSVD algorithm. Third, we provide an elegant solution to tackle the typical dimensionality inconsistency problem while working with multiple sub tensors. Finally, we carry out theoretical analyses with respect to dimensionality reduction, reconstruction error of *S*-tSVD, running time, and data security. We use real unstructured video data and semi structured XML documents, integrating them within a unified tensor model for decomposition. We demonstrate that the error ratio of the *S*-tSVD is lower than the same compression ratio compared to the SVD decomposition and tSVD-slice approaches. Moreover, the specific *S*-tSVD decomposition not only enables effective data mining and dimensionality reduction but also ensures the accuracy of the decomposition result and data privacy protection.