Acceleration of the EM algorithm using the vector epsilon accelerator and a re-starting procedure

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The Expectation-Maximization (EM) algorithm is a popular algorithm for finding maximum likelihood estimates from incomplete data. However, the EM algorithm converges slowly when the proportion of missing data is large. In order to circumvent the problem of slow convergence of the EM algorithm, the epsilon-accelerated EM algorithm can be used to speed up the convergence of the sequence of EM iterations using the vector epsilon algorithm. The vector epsilon algorithm is a vector transformation method and is a fairly simple computational procedure. The epsilon-accelerated EM algorithm consists of two steps: The first step is the expectation and maximization steps (the EM step) of the EM algorithm and the second step is the acceleration step using the vector epsilon algorithm. Then the acceleration algorithm only uses the sequence of estimates obtained by the EM algorithm to get an accelerated sequence for the EM sequence but does not change the original EM sequence. We find that the accelerated sequence often has larger values of the likelihood than the current estimate obtained by the EM algorithm. In order to further reduce the number of iterations and computation time, in this paper, we improve the epsilon-accelerated EM algorithm using a re-starting procedure. The re-starting procedure embedding in the acceleration step finds an initial value for re-starting the EM step such that a newly generated sequence of EM iterations from the value moves quickly into a neighborhood of a stationary point. When applying the epsilon-accelerated EM algorithm to the newly generated sequence, its speed of convergence can be increased. Therefore the use of the re-starting procedure makes the epsilon-accelerated EM algorithm converge faster. This algorithm has another advantage of simple implementation, since it only uses the EM iterations and re-starts the iterations by an estimate with a larger likelihood. The re-starting algorithm for the epsilon-accelerated EM algorithm can further improve the EM algorithm and the epsilon-accelerated EM algorithm in the sense of that it can reduces the number of iterations and computation time.

Key Words: acceleration of convergence, vector epsilon algorithm, re-starting procedure