IV.B.1. Solving Bayes' Equations: N+V Inversion Scheme

SAMMY uses coding similar to that in the code BAYES [NL82] to solve Bayes' equations in the N+V inversion scheme. In matrix notation, the noniterative form of Bayes' equations can be written

$$P' - P = M\,G^t \left(N + V\right)^{-1} \left(D - T\right) \qquad \text{(IV B1.1)}$$

and

$$M' = M - M\,G^t \left(N + V\right)^{-1} G\,M \quad , \qquad \text{(IV B1.2)}$$

where N is given by

$$N = G\,M\,G^t \quad . \qquad \text{(IV B1.3)}$$

Solving these equations is equivalent to solving

$$AX = Y \qquad \text{(IV B1.4)}$$

$K + 1$ times (where K is the number of parameters for the problem), with A the $L \times L$ symmetric matrix $N + V$ (where L is the number of data points), and Y a column matrix equal to $\left(D - T\right)$ in Eq. (IV B1.1) or equal to each of the K columns of the rectangular matrix GM in Eq. (IV B1.2).

The inverse of matrix A is not evaluated directly. Rather, A is first factorized as

$$A = U\,B\,U^t \qquad \text{(IV B1.5)}$$

where B is a block-diagonal matrix and U is the product of elementary unit triangular and permutation matrices, so that inverses of U and B are immediately available. The solution X to Eq.(IV B1.4) is then found from

$$X = \left(U^{-1}\right)^t B^{-1} U^{-1} Y \quad . \qquad \text{(IV B1.6)}$$

In SAMMY, the factorization of Eq. (IV B1.5) is performed by the LINPACK [JD79] subroutine SSPCO, and the ($K + 1$) solutions are obtained by LINPACK subroutine SSPSL (with the SAMMY author's updates for double precision). Subroutine NEWPAR oversees these operations.

As explained earlier, it is necessary to modify this procedure slightly to account for the approximations built into Bayes' equations. Details are given in Section IV.A.3.