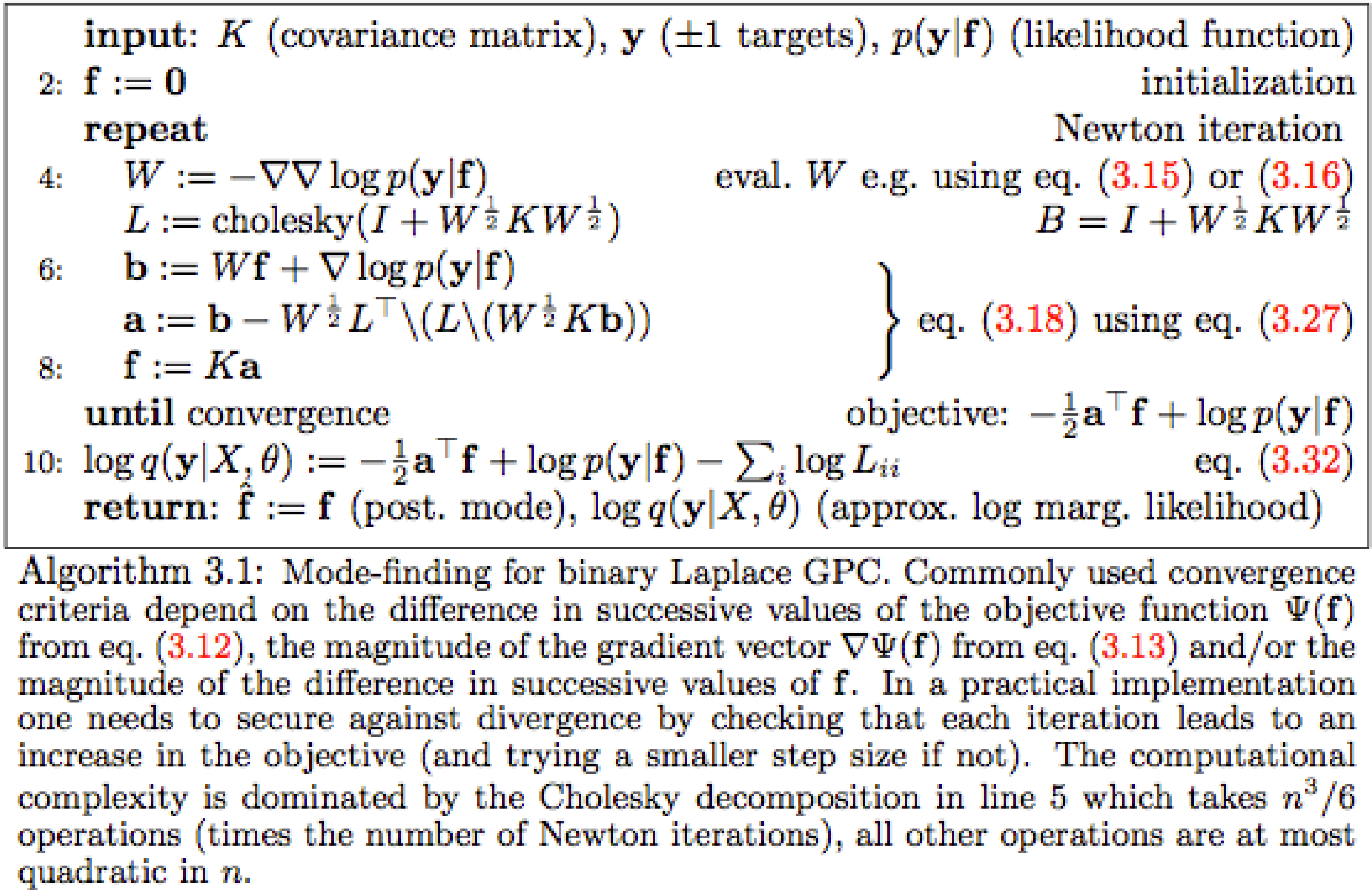

```
    input: $K$ (covariance matrix), $\mathbf{y}$ ($\pm 1$ targets), $p(\mathbf{y}|\mathbf{f})$ (likelihood function)
 2: $\mathbf{f} := \mathbf{0}$                                                   initialization
    repeat                                                                       Newton iteration
 4:     $W := -\nabla\nabla \log p(\mathbf{y}|\mathbf{f})$                       eval. $W$ e.g. using eq. (3.15) or (3.16)
        $L := \text{cholesky}(I + W^{\frac{1}{2}} K W^{\frac{1}{2}})$                  $B = I + W^{\frac{1}{2}} K W^{\frac{1}{2}}$
 6:     $\mathbf{b} := W\mathbf{f} + \nabla \log p(\mathbf{y}|\mathbf{f})$         }
        $\mathbf{a} := \mathbf{b} - W^{\frac{1}{2}} L^\top \backslash (L \backslash (W^{\frac{1}{2}} K \mathbf{b}))$   } eq. (3.18) using eq. (3.27)
 8:     $\mathbf{f} := K\mathbf{a}$                                              }
    until convergence                                                            objective: $-\frac{1}{2}\mathbf{a}^\top\mathbf{f} + \log p(\mathbf{y}|\mathbf{f})$
10: $\log q(\mathbf{y}|X,\theta) := -\frac{1}{2}\mathbf{a}^\top\mathbf{f} + \log p(\mathbf{y}|\mathbf{f}) - \sum_i \log L_{ii}$   eq. (3.32)
    return: $\hat{\mathbf{f}} := \mathbf{f}$ (post. mode), $\log q(\mathbf{y}|X,\theta)$ (approx. log marg. likelihood)
```

Algorithm 3.1: Mode-finding for binary Laplace GPC. Commonly used convergence criteria depend on the difference in successive values of the objective function $\Psi(\mathbf{f})$ from eq. (3.12), the magnitude of the gradient vector $\nabla\Psi(\mathbf{f})$ from eq. (3.13) and/or the magnitude of the difference in successive values of $\mathbf{f}$. In a practical implementation one needs to secure against divergence by checking that each iteration leads to an increase in the objective (and trying a smaller step size if not). The computational complexity is dominated by the Cholesky decomposition in line 5 which takes $n^3/6$ operations (times the number of Newton iterations), all other operations are at most quadratic in n.