let n be the number of rows and m be the number of columns, and wlog assume $n \geq m$.
1. $O(m^2 n)$.
2. This can be reduced to the problem of counting C_4 in a graph (i.e. cycles with length 4). The vertices are the rows and the columns, and the edges are the grid entries with value 1.
$O(n^\omega)$ using matrix multiplication [1], or $O(|E|^{\frac{4}{3}}) = O(n^{\frac{8}{3}})$ [2] (combinatorial algorithm; need the counting version).
https://chaoxuprime.com/posts/2015-02-02-rectangle-in-point-set.html

remark. for arbitrary n points, finding axis-parallel rectangles takes $O(n^{2-1/d}) = O(n^{\frac{3}{2}})$ time [3], and also $O(n^{4/3})$ [2].

References

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