This is poj1981. let k denote the solution size.
1. draw a circle at each point with radius r, then we get $O(n^2)$ regions. check the depth of each region. $O(n^2 \log n)$ or $\tilde{O}(nk)$.
2. reduce to the smallest k-enclosing circle problem, which can be solved in expected $O(nk)$ time [2], or deterministic $O(nk \log^2 n)$ time [1]. binary search may add an additional $O(\log n)$ factor.

References

[1] Alon Efrat, Micha Sharir, and Alon Ziv. Computing the smallest k-enclosing circle and related problems. *Computational Geometry*, 4(3):119–136, 1994.

[2] Sariel Har-Peled and Soham Mazumdar. Fast algorithms for computing the smallest k-enclosing circle. *Algorithmica*, 41(3):147–157, 2005.