Chan [**?**] has obtained an algorithm for 3SUM that runs in time

$$O\left(\frac{n^2(\log\log n)^{O(1)}}{\log^2(n)}\right)$$

DONE

1 Further results

DONE

Barequet and Har-Peled [**?**] proved that the following problems (and more) are 3SUM-hard. They are from computational geometry. Some care must be taken to define these problems rigorously since the inputs are real numbers. We ignore such issues.

1. Given two simple polygons P and Q, determine if P can be translated to fit inside Q.
2. Given two simple polygons P and Q, determine if P can be translated and rotated to fit inside Q.
3. Given two simple polygons P and Q, determine if P can be rotated around a given point to fit into Q
4. Given P, a finite sets of reals, and a set S of intervals of real numbers, determine if there a $u \in \mathsf{R}$ so that $P + u \subseteq S$?

Once we know that a problem is 3SUM-hard, what do do? One idea is to try for an efficient approximation. Alman & McKay [**?**] showed the following problems is 3SUM-hard, and then gave some approximation algorithms for it.

Def 1.1 (This definition is informal.) Given n players of a game, and how good they are at different roles in the game (e.g., in soccer we have roles of goalkeeper, defender, midfield, or forward). pick out two disjoint teams of k players that will minimize the difference in the skill levels of the teams. This problem has immediate applications to many popular online video games such as *League of Legends* and *Dota 2*.

Sometimes the 3SUM-conjecture implies hardness results, but not from a reduction. We give two examples.

1. Kopelowitz et al. [**?**] show that, assuming the 3SUM conjecture, several triangle-enumeration algorithms are optimal.

2. Kopelowitz et al. [**?**] show that, assuming the 3SUM conjecture, any static data structure for Set Disjointness that answers queries in constant time must spend $\Omega(N^{2-o(1)})$ time in preprocessing, where N is the number of sets.