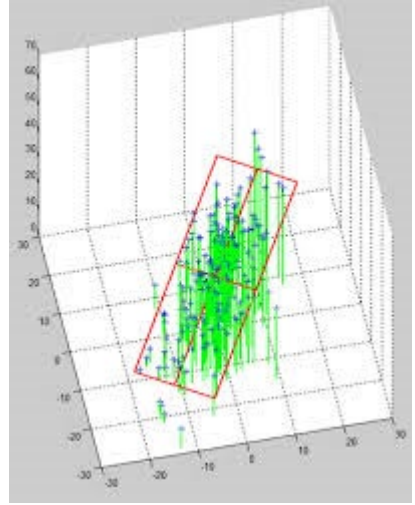


## Approximation Algorithms for Metric Fitting Problems

- 임의의 거리 데이터가 주어졌을 때, 어떻게 하면 최소한의 수정을 통해 평면 거리로 변환할 수 있을까?



- 이러한 Metric fitting 알고리즘들은 오랫동안 쓰이고 연구되어 왔지만 최근에 들어서야 성능의 이론적인 증명이 이루어지기 시작했다.

- 이 문제들에 대한 새로운 알고리즘 또는 기존 알고리즘들의 성능 분석을 발견해 보자.

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# Approximation Algorithms for Metric Fitting Problems

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- Consider the following basic optimization problem called FITTING 2-DIMENSIONAL METRICS: Given a set of points  $X$  and the distance data  $d \in \mathbb{R}^{\binom{X}{2}}$ , the goal is to compute a map  $f : X \rightarrow \mathbb{R}^2$  to minimize the number of pairs  $(i, j) \in \binom{X}{2}$  with  $d(i, j) \neq \|f(i) - f(j)\|_2$ . Intuitively, we would like to minimally change the given arbitrary distance data  $d$  to one representable in the Euclidean plane.
- It belongs to more general classes of *dimensional reduction* and *metric fitting/embedding* problems. Though these fields have been actively studied with many proposed algorithms and analysis, the rigorous guarantee of objective functions have recently started to be studied. This recent study also revealed interesting connections to other fundamental classes of optimization problems, including Constraint Satisfaction Problems (CSPs).
- This problem is believed to be NP-hard to find an exactly optimal solution, but it is possible that the problem admits a polynomial-time approximations scheme; for any fixed  $\varepsilon > 0$ , a polynomial-time algorithm that returns a  $(1 + \varepsilon)$ -approximation algorithm.
- The main goal of this project is: design a PTAS for FITTING 2-DIMENSIONAL METRICS. It is also possible to explore more related problems.
- Prerequisite: Basic knowledge in design and analysis of algorithms, mathematical maturity, and interest in approximation algorithms.