How to prove a multi-objective optimization problem is Np-hard?

Yes. If one of your multi-objective functions correspond to a NP-complete (decision problem) you can easily prove NP-Completeness: If you had an algorithm to solve

the Multi objective problem to optimality (i.e. finding the pareto-front), you could

take any single-dimension version of your NP-hard problem and add a constant

objective function. The use your multi-objective optimization algorithm and you have solved the NP complete problem.

Yes we can simplify our problem by fixing one dimension that is cyclicity. Now we look only on solution that maximizes number of matching and maximizes the value of similarity of matched pairs. This corresponds to inexact matching.

Inexact matching: consist on making the matching process tolerant in respect to deformations by introducing the concept of matching cost to penalize structural differences. The closer are the struc- tures of the two graphs, the lower is the cost to match them.

Inexact GM problem can be formulated as a quadratic assignment problem (QAP) [77], being well-known NP-complete [49].