1. What is the task tackled in this paper?

- entity alignment

2. What is the research question in this paper?

- Previous work has too hard constraints on the tranformation mapping.
- Previous work can only use the alignment information of two-graphs, cannot make full use of multi-graphs(>2).
- High cost when aligning between N graphs in previous work, in which order is O(N!).

3. How to solve it/what is the approach of this paper?

- The framework of model is still be a joint model of two parts :
  - relational inference model : Regard as a controlled variable. We will use TransE.
  - Alignment model : replace hard constraints, such as linear transformation and translation constraints, with soft constraints - wasserstein metric.
- The Wasserstein transport mapping space $T \in \mathbb{R}^{m*n}$ between two graph embedding spaces $X = (x_1, \ldots, x_m) \in \Omega^m, Y = (y_1, \ldots, y_n) \in \Omega^n$ should have two constraint conditions:
  - The mapping should be continuous for distance under its space metric.

    (Should be continuous mapping between two spaces, maybe homeomorphism?)
- Train:
  - Wasserstein metric between **two graphs** with alignment pair (x_i, y_j)
    - Simplily take wasserstein distance as loss function.
    - The transport value of alignment entities should be:

      $T(x_i, y_j) = \sum_k^n T(x_i, y_k)\ (x_i \in \mathbb{R}^m, y_j \in \mathbb{R}^n)$
  - Wasserstein metric among **k graphs** with alignment list $(x_{i_1}^1, \ldots, x_{i_k}^k)$:
    - Calculate the Wasserstein barycenter $S \in \Omega^x$ of n graph embedding spaces firstly.
    - Each entity in alignment list $(x_{i_1}^1, \ldots, x_{i_k}^k)$ has a coresponding distribution $P_{i_j}^j$ which is the i_j-th row of transport mapping matrix between graph embedding space X^j and barycenter S. We note it as $(P_{i_1}^1, \ldots, P_{i_k}^k)$. We need all the distributions in this list to be same.
- Predict:

  Predict in the way we trained it on different problems (Two graphs and N-graphs).

4. Summary & Questions

1) Questions

- How do you think about this plan, enve it's only theoritcal and not concret now.
- **Just an opinion:** I think it may be unsatisfactory using Wasserstein distance as alignment loss function. Because it only has very weak constraint on embedding space.

2) Summary

- It's a joint model, because alignment loss is related to relational inference loss.
- I think using the first and second items (in section2) as motivations is better than high computation cost deficiency.
- Anyway, The next step is to find the optimization method and do an experiment to verify the effect.