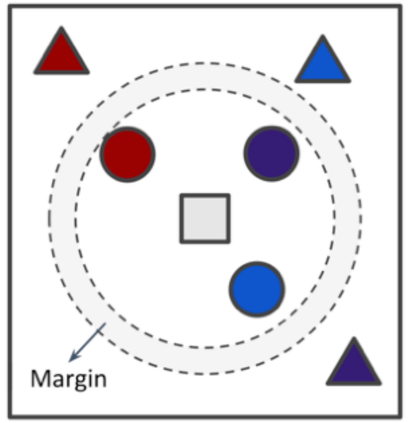
Proposed Method

Metric Learning with Interest Sustainability Score



(a) CML

- $L_C(u, i^+, i^-) = [m + d(\mathbf{u}, \mathbf{i}^+) - d(\mathbf{u}, \mathbf{i}^-)]_+$
- Used euclidean distance as a distance metric d.
- Margin $m \in \mathbb{R}_{>0}$ imposes u to be closer to i^+ than i^- by m in the representation space.
- Impose the space to be a unit sphere by normalizing the embedding vectors (e.g., $\mathbf{u} \leftarrow \mathbf{u}/\max(1, \|\mathbf{u}\|^2)$) for each epoch.

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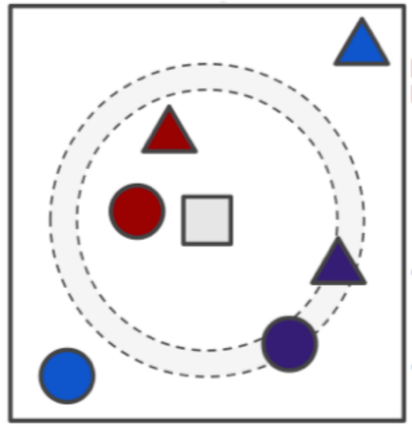

(b) CRIS^{reg}

- Incorporate the ISS in the above metric learning framework to consider how users' interest in each item will sustain in the future.
- The underlying idea is pull items with high ISS to users and to push items with low ISS from users.
- Design a ISS-based objective L_S with continuous labels (p_i):
  - $L_S(u, i^+, i^-) = \{(d(\mathbf{u}, \mathbf{i}^+) - d(\mathbf{u}, \mathbf{i}^-)) - (p_{i^-} - p_{i^+})\}^2$
- The goal of L_S is to arrange item i^+ and i^- by according to the difference of their ISSs ($p_{i^-} - p_{i^+}$).
- For example, if $p_{i^-} - p_{i^+} < 0$, the objective makes the positive item will be closer to the user than the negative item by $|p_{i^-} - p_{i^+}|$.