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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Introduction to Large Language Models (LLMs)

(course)

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Course
outline

**About NPTEL
()**

**How does an
NPTEL online
course work?
()**

Week 1 ()

Week 2 ()

Week 3 ()

Week 4 ()

Week 5 ()

Week 6 ()

Week 7 ()

Week 8 ()

Week 11 : Assignment 11

The due date for submitting this assignment has passed.

Due on 2025-04-09, 23:59 IST.

Assignment submitted on 2025-04-06, 22:19 IST

1) What is the main modification that SimplE makes to DistMult-like models to handle   ***1 point***
asymmetric relations?

○ Replacing entity embeddings with random fixed vectors

◉ Introducing separate entity embeddings for subject and object roles, along with inverse
relations

○ Restricting the rank of the relation tensor to 1

○ Using negative sampling for half of the triple set

Yes, the answer is correct.
Score: 1

Accepted Answers:
Introducing separate entity embeddings for subject and object roles, along with inverse relations

2) Which statements correctly characterize the basic DistMult approach for knowledge   ***1 point***
graph completion?

☐ Each relation r is parameterized by a full D×D matrix that can capture asymmetric relations.

☑ The relation embedding is a diagonal matrix, leading to a multiplicative interaction of entity
embeddings.

☑ DistMult struggles with non-symmetric relations because score(s, r, o) = $a_s^T M_r a_o$ is inherently
symmetric in s and o.

☐ DistMult's performance is typically tested only on fully symmetric KGs.

Yes, the answer is correct.
Score: 1

Accepted Answers:
*The relation embedding is a diagonal matrix, leading to a multiplicative interaction of entity
embeddings.*
*DistMult struggles with non-symmetric relations because score(s, r, o) = $a_s^T M_r a_o$ is inherently
symmetric in s and o.*

3) Which statements about the ComplEx extension of DistMult are true? **1 point**

☑ It uses complex-valued embeddings to better capture asymmetric or anti-symmetric relations.

☐ It replaces the multiplication in DistMult with element-wise addition of real-valued vectors.

☑ For a perfectly symmetric relation, one could set the imaginary part of the relation embedding to zero.

☑ ComplEx requires each entity vector to be unit norm in the complex plane.

No, the answer is incorrect.
Score: 0

Accepted Answers:
It uses complex-valued embeddings to better capture asymmetric or anti-symmetric relations.
For a perfectly symmetric relation, one could set the imaginary part of the relation embedding to zero.

4) Which best describes the main advantage of using a factorized representation (e.g., **1 point**
DistMult, ComplEx) for large KGs?

◯ It enforces that every relation in the KG be perfectly symmetric.

◯ It ensures each entity is stored as a one-hot vector, simplifying nearest-neighbour queries.

◯ It collapses the entire KG into a single scalar value.

◉ It significantly reduces parameters and enables generalization to unseen triples by capturing low-rank structure.

Yes, the answer is correct.
Score: 1

Accepted Answers:
It significantly reduces parameters and enables generalization to unseen triples by capturing low-rank structure.

5) Which statement best describes the reshaping of a 3D KG tensor $X \in R^{|E| \times |R| \times |E|}$ into a **1 point**
matrix factorization problem?

◯ One axis remains for subject, one axis remains for object, and relations are combined into a single expanded axis.

◯ The subject dimension is repeated to match the relation dimension, resulting in a 2D matrix.

◉ Each subject–relation pair is collapsed into a single dimension, while objects remain as separate entries.

◯ The entire KG is vectorized into a 1D array and then factorized with an SVD approach.

Yes, the answer is correct.
Score: 1

Accepted Answers:
Each subject–relation pair is collapsed into a single dimension, while objects remain as separate entries.

6) Which key property of hierarchical relationships (e.g. is-a, transitivity) motivates the **1 point**
exploration of specialized embedding methods over standard Euclidean KG embeddings?

◯ Symmetry in the relation (A, is-a, B) implying (B, is-a, A)

◯ Frequent presence of cycles in hierarchical graphs

◉ Transitivity in the form (camel, is-a, mammal) and (mammal, is-a, animal) $\Rightarrow$ (camel,is-a,animal)

◯ The high dimensionality of the entity embeddings

Yes, the answer is correct.
Score: 1

Accepted Answers:
Transitivity in the form (camel, is-a, mammal) and (mammal, is-a, animal) $\Rightarrow$ (camel,is-a,animal)

7) Which of the following statements correctly describe hyperbolic (Poincare) embeddings **1 point**
for hierarchical data?

- ☑ They map nodes onto a disk (or ball) such that large branching factors can be represented with lower distortion than in Euclidean space.
- ☑ Distance grows slowly near the center and becomes infinite near the boundary, making it naturally suited for tree-like structures.
- ☐ They require each node to be embedded on the surface of the Poincare disk of radius 1.
- ☐ They can achieve arbitrarily low distortion embeddings for trees with the same dimension as Euclidean space.

Yes, the answer is correct.
Score: 1
Accepted Answers:
They map nodes onto a disk (or ball) such that large branching factors can be represented with lower distortion than in Euclidean space.
Distance grows slowly near the center and becomes infinite near the boundary, making it naturally suited for tree-like structures.

8) Why might a partial-order-based approach (like order embeddings) be beneficial for **1 point**
modelling 'is-a' relationships compared to purely distance-based approaches?

- ☐ They explicitly encode the ancestor–descendant relation as a coordinate-wise inequality or containment.
- ☐ They can represent negative correlations (i.e., sibling vs. ancestor) more easily than distance metrics.
- ☑ They inherently guarantee transitive closure of the hierarchy in the learned embedding space.
- ☑ They do not rely on pairwise distances but use a notion of coordinate-wise ordering or interval containment.

No, the answer is incorrect.
Score: 0
Accepted Answers:
They explicitly encode the ancestor–descendant relation as a coordinate-wise inequality or containment.
They do not rely on pairwise distances but use a notion of coordinate-wise ordering or interval containment.

9) Which statement about box embeddings in hierarchical modelling is most accurate? **1 point**

- ○ Each entity or type is assigned a single real-valued vector, ignoring bounding volumes.
- ◉ Containment $I_x \subseteq I_y$ across all dimensions encodes $x < y$.
- ○ They rely on spherical distances around a central node to measure tree depth.
- ○ They cannot be used to represent set intersections or partial overlap.

Yes, the answer is correct.
Score: 1
Accepted Answers:
Containment $I_x \subseteq I_y$ across all dimensions encodes $x < y$.

10) What is a key challenge with axis-aligned open-cone (order) embeddings for hierarchical **1 point**
KG data?

- ◉ They enforce that all sibling categories have identical cone apices, which causes overlap.
- ○ They require symmetrical relationships for all edges.
- ○ They do not allow partial orders to be extended to total orders.
- ○ The volume (measure) of cones is the same regardless of how "broad" or "narrow" the cone is, making sub-categories indistinguishable by volume.

No, the answer is incorrect.

Score: 0