

Peer Review

Review of: "(De)-Indexing and the Right to be Forgotten"

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I have reviewed the paper you provided, and here is the detailed feedback on the technical aspects, including equations:

General Observations:

Clarity of Concepts: The paper introduces foundational concepts of Information Retrieval (IR) models in a clear manner. The explanation of de-indexing, the right to be forgotten (RTBF), and the technical models of IR are well structured, providing a good overview for non-experts.

Structure and Organization: The paper follows a logical flow, progressing from the basics of information retrieval to more advanced concepts like embeddings, LLMs, and their implications on RTBF.

Technical Language: The use of technical terms is appropriate for the subject matter, though there are sections that might require simplification for non-experts. However, this depends on the intended audience, and for academic readers, the depth is adequate.

Equations and Mathematical Formulation:

Upon reviewing the equations, the following points are worth noting:

1. Term-Document Matrix (TDM) Equation:

- There is an equation shown where a function is used to quantify the association between a term and a document. However, the equation is not fully clear in its notation due to formatting. It might be more explicit if written as:

$$f(t_i, D_j) = \text{TF}(t_i, D_j) \quad f(t_i, D_j) = \text{Binary Representation}$$

\quad \text{or} \quad \text{TF-IDF}

2. Term Frequency (TF) Equation:

- The TF equation is not displayed in the most readable manner. The equation is intended to capture the frequency of terms in a document, but it should be explicitly written as:

$$\text{TF}(t_i, D_j) = \frac{\text{count of term } t_i \text{ in } D_j}{\text{total terms in } D_j}$$

3. Cosine Similarity:

- The cosine similarity formula is used appropriately. However, the notation can be cleaned up for clarity. Here is the correct form:

$$\text{CosineSimilarity}(D_j, q) = \frac{D_j \cdot q}{\|D_j\| \|q\|}$$

4. BM25 Formula:

- The BM25 formula is presented correctly with its components, but the equation might benefit from clearer notation for the tuning parameters and . The formula should read:

$$\text{BM25}(D_j, q) = \sum_{t \in q} \text{IDF}(t) \cdot \frac{\text{TF}(t, D_j)}{(k_1 + 1)} \cdot \frac{\text{TF}(t, D_j) + k_1}{(1 - b + b \cdot \frac{|D_j|}{\text{avglen}})}$$

Embedding Equations:

- The mathematical representation of word and document embeddings is mostly correct, but some expressions could be better clarified with clearer notation. For instance, when describing embeddings as vectors, it's helpful to indicate their dimensionality. Use symbols like $\mathbf{w}$ for word embeddings and $\mathbf{d}$ for document embeddings.

Fine-Tuning Formula:

- The fine-tuning phase for large language models is clearly explained, but the equation for the loss function should be written as:

$$L(\theta) = - \sum_{i=1}^N \log P_{\theta}(t_i | t_1, t_2, \dots, t_{i-1})$$

Suggestions for Improvement:

Consistency in Notation: Ensure that all equations and terms are consistently defined and formatted throughout the document. Some equations, especially those involving term frequencies or BM25, can be

improved for clarity.

Clarity in Descriptions: While the technical explanations are generally strong, some sections could benefit from additional context or examples to illustrate the impact of de-indexing and RTBF on information retrieval systems. Examples involving real-world applications (such as GDPR or the Google Spain case) could provide a more concrete understanding.

References and Citations: It would be useful to align the equation references with the relevant sources in the text for further clarity, especially in sections discussing models like BM25 or probabilistic relevance.

Mathematical Precision: Ensure that all formulas are presented with the correct mathematical symbols and in a consistent manner, especially for the more complex models like probabilistic models or BM25. This will help make the equations more readable and understandable for a wider audience.

Conclusion:

The paper provides a well-rounded technical discussion on the role of IR models in the context of the right to be forgotten. The equations, while generally correct, could be improved with clearer formatting, more precise definitions, and consistent notation. The core content is strong, but the technical details—especially in the mathematical formulations—would benefit from further refinement.

Declarations

Potential competing interests: No potential competing interests to declare.