We study the imbalance between current state-of-the-art tag recommendation algorithms and the folksonomy structures of real-world social tagging systems. While algorithms such as FolkRank are designed for dense folksonomy structures, most social tagging systems exhibit a sparse nature. To overcome this imbalance, we show that cognitive-inspired algorithms, which model the tag vocabulary of a user in a cognitive-plausible way, can be helpful. Our present approach does this via implementing the activation equation of the cognitive architecture ACT-R, which determines the usefulness of units in human memory (e.g., tags). In this sense, our long-term research goal is to design hybrid recommendation approaches, which combine the advantages of both worlds in order to adapt to the current setting (i.e., sparse vs. dense ones).

**RQ1: Activation Processes and Reuse of Tags**

How are activation processes in human memory influencing the tag reuse behavior of users in social tagging systems?

- The more frequently a tag was used in the past, the higher its reuse probability.
- The more recently a tag was used in the past, the higher its reuse probability.
- The more similar a tag is to current semantic context, the higher its reuse probability.

**RQ2: ACT-R for Social Tag Recommendations**

Can the activation equation of the cognitive architecture ACT-R be exploited to develop a tag recommendation algorithm, which is capable of overcoming the imbalance between current approaches and real-world folksonomy structures?

- Current tag recommendation algorithms are designed in a purely data-driven way (e.g., tag popularity, user similarities, topic modeling, factorization of resource features, etc.).
- This means that they rely on dense folksonomy structures but most real-world folksonomies are sparse.

**RQ3: Hashtag Recommendations in Twitter**

Can ACT-R be generalized for related use cases in the research area of tag-based recommender systems, such as hashtag recommendations in Twitter?

**Approach**

- The way users choose tags for their resources strongly corresponds to processes in human memory and its cognitive structures.
- Activation equation of ACT-R formalizes the usefulness of a memory unit depending on general usefulness (i.e., frequency and recency) and usefulness in current semantic context:

\[
A_i = \ln(\sum_{j=1}^{n} F_{ij}^{-1}) + \sum_{j} (W_{ij} \cdot S_{ij})
\]

**Evaluation Framework**