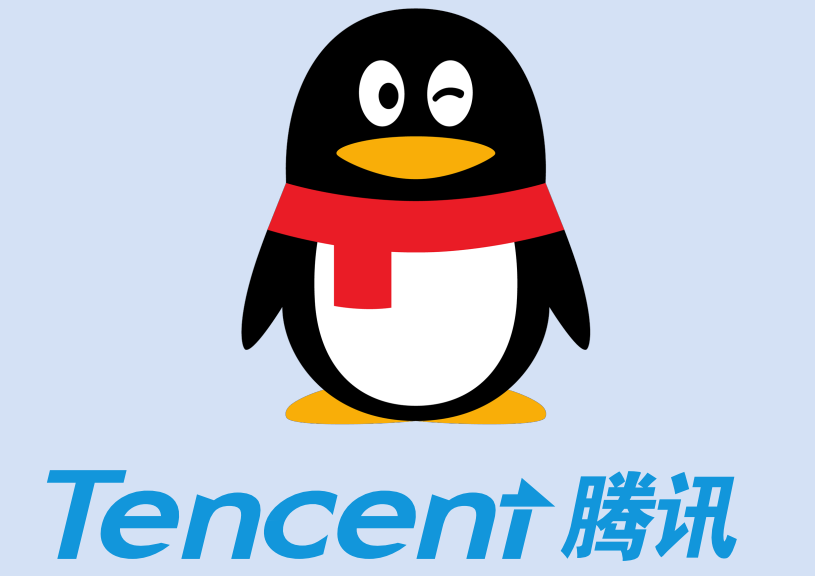# Editing Language Model-Based Knowledge Graph Embeddings

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Introduction

- A brand new task for editing language model-based KG embeddings.
- An efficient knowledge editing method: **KGEditor**, which can efficiently modify incorrect knowledge or add new knowledge without affecting the rest of the acquired knowledge.
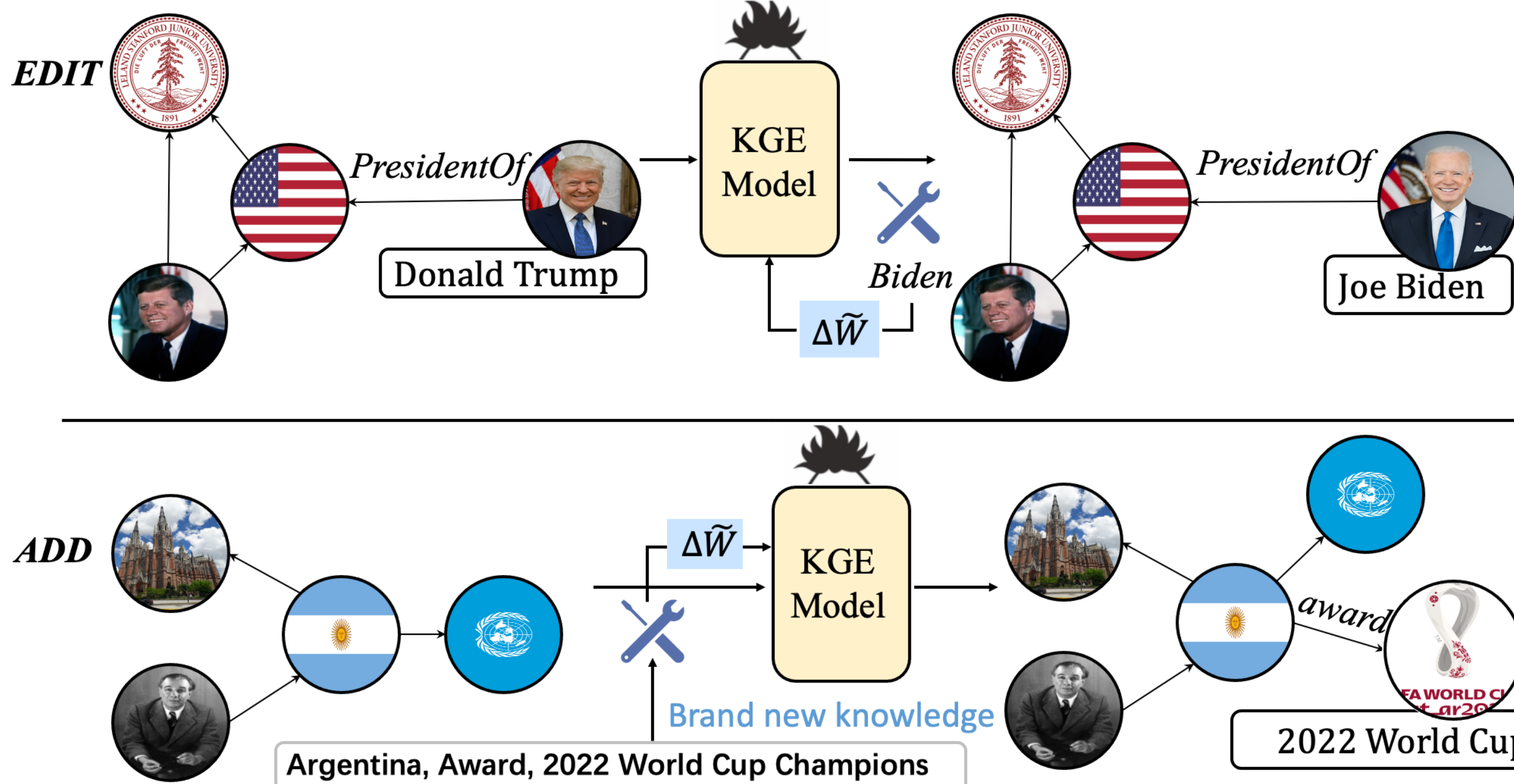

Figure 1: Knowledge Graph Embedding Editing.

KGEditor

- **KGEditor** capitalizes on the advantages of external model-based methods and additional parameter-based methods, which employ additional parameters through hypernet.
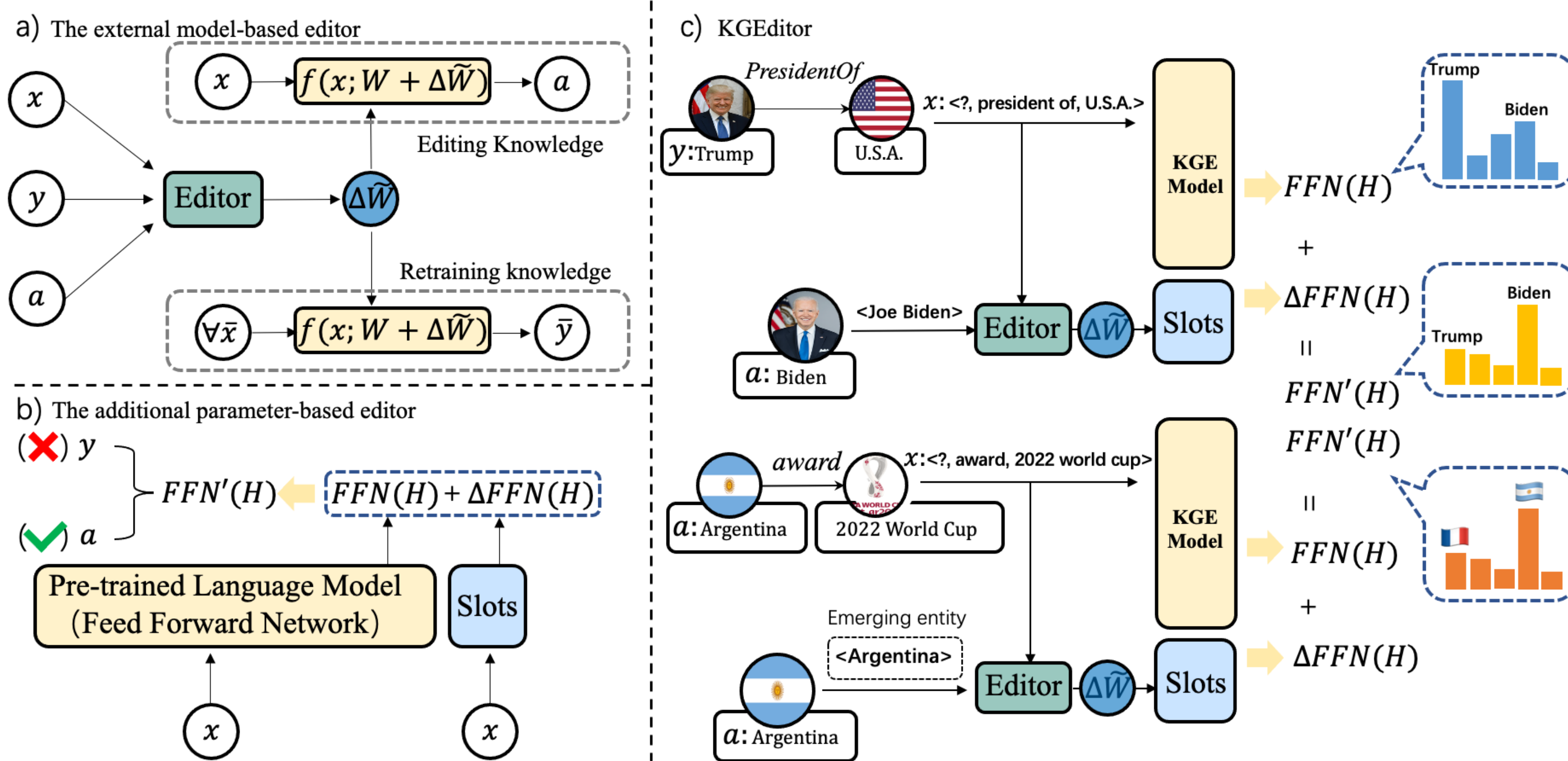

Figure 1: Knowledge Graph Embedding Editing.

Datasets

We build datasets on two datasets **FB15k-237** and **WN18RR**.
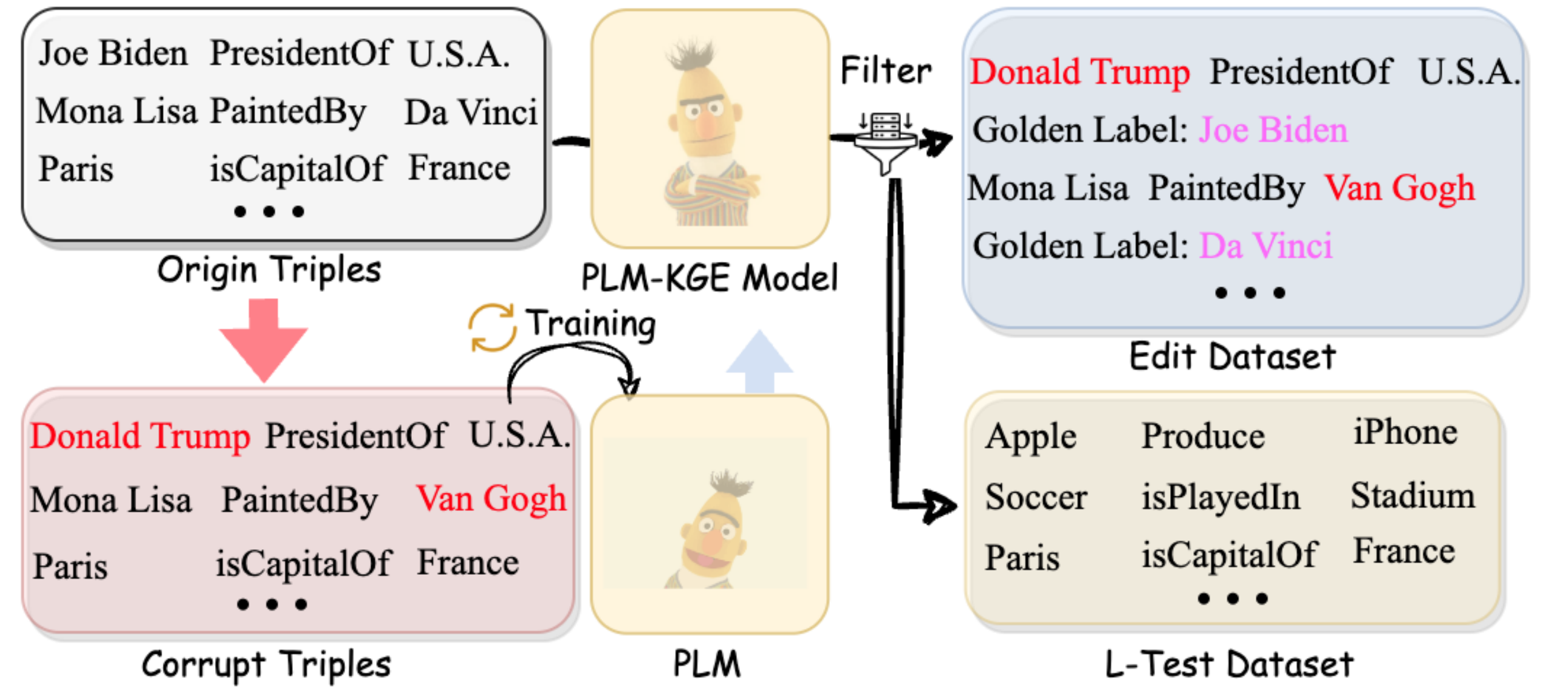
- *Edit Subtask Dataset Construction*

Figure 2: Generality dataset construction process.

- *Add Subtask Dataset Construction*

We use the data from the standard inductive setting.

Metrics

- *Knowledge Reliability*

Evaluate if edited knowledge is correctly inferred via link prediction.

We define the **Success@1 metric** (Succ@k) by counting the number of the correct triples that appear at the position k.

- *Knowledge Locality*

Evaluate if editing affects the rest of the acquired knowledge.

$$RK@k = \frac{\sum f(x'; \mathcal{W} + \triangle \tilde{\mathcal{W}})_{\leq k}}{\sum f(x'; \mathcal{W})_{\leq k}}$$

To better present the effect of editing, we introduce two additional metrics: **Edited Knowledge Rate of Change** ER_{roc} and **Retaining Knowledge Rate of Change** RK_{roc}.
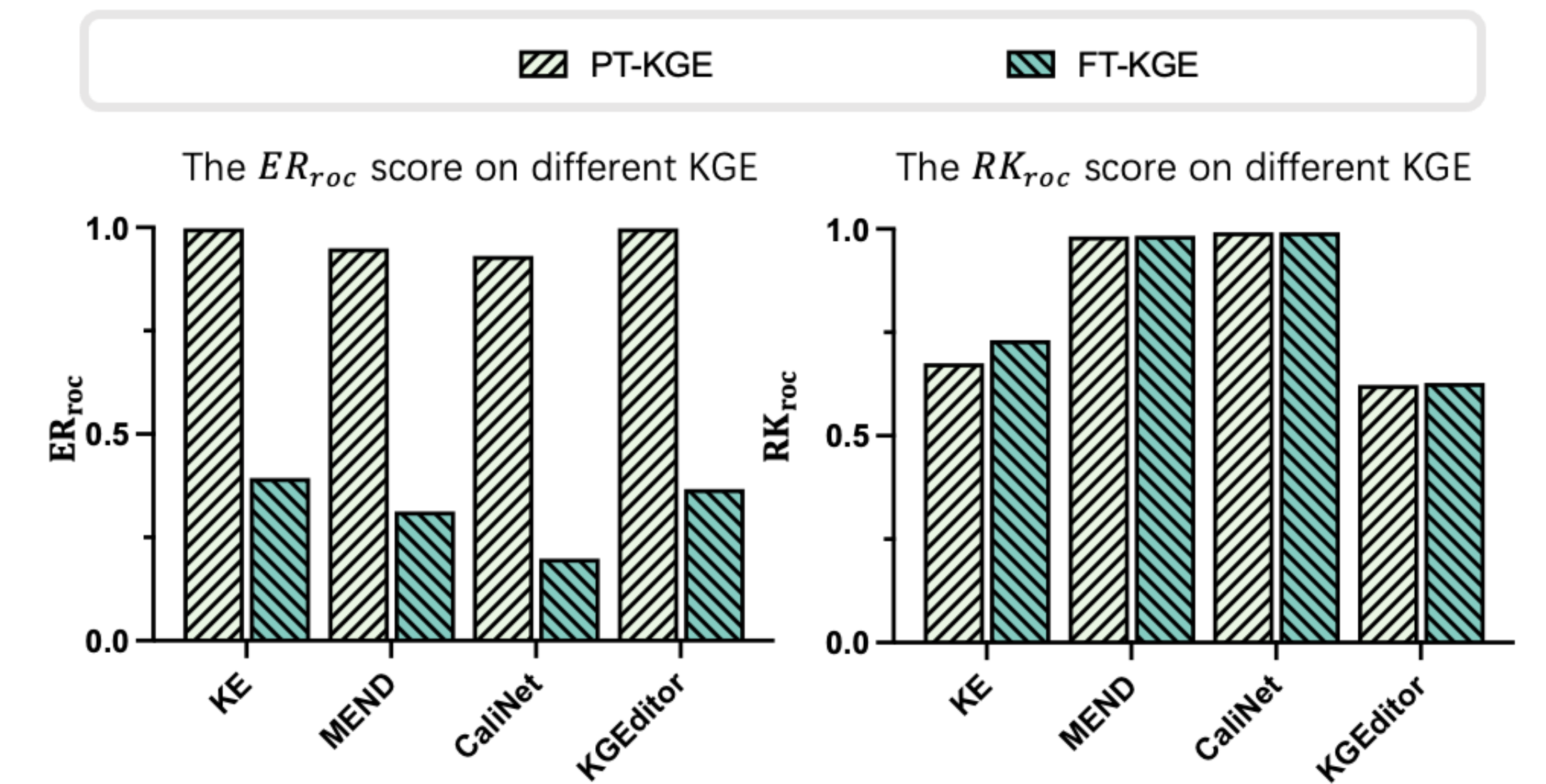
- *Edited Knowledge Rate of Change*
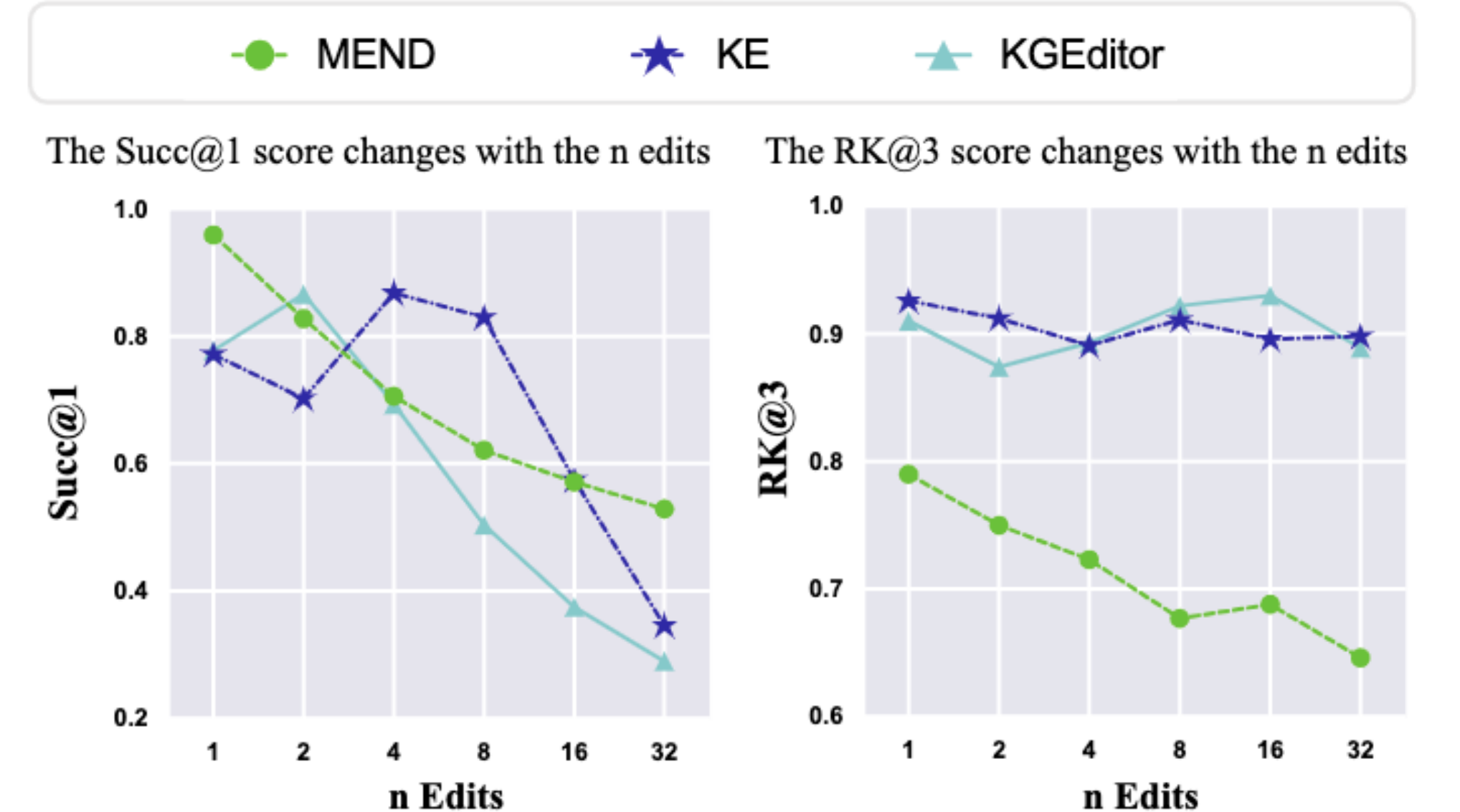
$$EK_{roc} = \frac{|R_{edit} - R_{origin}|}{R_{origin}}$$

- *Retaining Knowledge Rate of Change*

$$RK_{roc} = \frac{|R_{s\_edit} - R_{s\_origin}|}{R_{s\_edit}}$$

Experiment

- **The main result of the EDIT sub-task on E-FB15k237 and E-WN18RR.**

Method	Params	E-FB15k237						E-WN18RR					
		Time ↓	Succ@1 ↑	Succ@3 ↑	ER_{roc} ↑	RK@3 ↑	RK_{roc} ↓	Time ↓	Succ@1 ↑	Succ@3 ↑	ER_{roc} ↑	RK@3 ↑	RK_{roc} ↓
		No Model Edit											
KGE_FT	121M	0.103	0.472	0.746	0.998	0.543	0.977	0.109	0.758	0.863	0.998	0.847	0.746
KGE_ZSL	0M	0.000	0.000	0.000	-	1.000	0.000	0.000	0.000	0.000	-	1.000	0.000
K-Adapter	32.5M	0.056	0.329	0.348	0.926	0.001	0.999	0.061	0.638	0.752	0.992	0.009	0.999
		Model Edit Method											
CALINET	0.9M	0.257	0.328	0.348	0.937	0.353	0.997	0.238	0.538	0.649	**0.991**	0.446	0.994
KE	88.9M	0.368	0.702	0.969	**0.999**	**0.912**	0.685	0.386	0.599	0.682	0.978	0.935	**0.041**
MEND	59.1M	0.280	0.828	0.950	0.954	0.750	0.993	0.260	0.815	0.827	0.948	0.957	0.772
KGEditor	38.9M	0.226	**0.866**	**0.986**	0.999	0.874	**0.635**	0.232	**0.833**	0.844	0.991	0.956	0.256

- **The main result of the ADD sub-task on A-FB15k237 and A-WN18RR.**

Method	Params	A-FB15k237						A-WN18RR					
		Time ↓	Succ@1 ↑	Succ@3 ↑	ER_{roc} ↑	RK@3 ↑	RK_{roc} ↓	Time ↓	Succ@1 ↑	Succ@3 ↑	ER_{roc} ↑	RK@3 ↑	RK_{roc} ↓
		No Model Edit											
KGE_FT	121M	0.100	0.906	0.976	0.999	0.223	0.997	0.108	0.997	0.999	0.999	0.554	0.996
KGE_ZSL	0M	0.000	0.000	0.000	-	1.000	0.000	0.000	0.000	0.000	-	1.000	0.000
K-Adapter	32.5M	0.055	0.871	0.981	0.999	0.000	0.999	0.061	0.898	0.978	0.999	0.002	0.999
		Model Edit Method											
CALINET	0.9M	0.261	0.714	0.870	0.997	0.034	0.999	0.275	0.832	0.913	0.995	0.511	0.989
KE	88.9M	0.362	0.648	0.884	0.997	**0.926**	0.971	0.384	0.896	0.996	**0.999**	**0.975**	0.090
MEND	59.1M	0.400	0.517	0.745	0.991	0.499	0.977	0.350	**0.999**	1.0	0.999	0.810	0.987
KGEditor	58.7M	0.203	0.796	**0.923**	**0.998**	0.899	**0.920**	0.203	**0.998**	1.0	0.999	0.956	0.300

- **FT-KGE&PT-KGE**

- **Number of Edited Knowledge**

Insight

- *How to edit knowledge with many-to-many relations and integrate LLMs editing techniques?*

Paper:

Code: