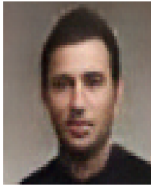# Supplementary Materials for EMNLP 2018 Paper:
Embedding Multimodal Relational Data for Knowledge Base Completion

1 Experiment Setup Details

For a fair comparison, we implement all methods using the identical loss and optimization for training, i.e., AdaGrad and the binary cross-entropy loss. We tune all the hyperparameters on the validation data and use grid search to find the best hyperparameters, such as regularization parameter $\lambda = [10^{-6}, 3 \times 10^{-6}]$, and dimensionality of embedding $d = [128, 200, 250, 360, 400]$. We use commonly-used metrics for evaluation: mean reciprocal rank (MRR) and Hits@K for link prediction, and RMSE for number/rating prediction. We find that the following combination of parameters works well on our datasets. For MovieLens, embedding size 400, batch size 128, and learning rate 0.003. For YAGO dataset, we consider embedding size 200, batch size 128, and learning rate 0.001. Further, we choose size of all the hidden layers to be equal to the embedding size.

For generating text, we use ARAE-Gan (Zhao et al., 2017) with embedding size 300, and learning rate 5×10^{-5} for generator and 10^{-5} for discriminator. In addition to feeding entity embeddings as the conditional information to our discriminator and generator, we implement an $L1$ loss between the continuous codes of the output of generator and the reference description corresponding to that specific entity (whose embedding is fed to the generator), with coefficient of 0.1. Similarly, for image generator we consider embedding size 200 with latent z dimension of 64. Further, we choose learning rate 0.0001 and batch size 16. Moreover, similar to the text generator, we consider an $L1$ loss for generator with coefficient of 0.1.

The open source implementation of all our models, with the datasets and the selected hyperparameters, is available at https://github.com/pouyapez/mkbe to reproduce our results.

Figure 1: Screenshot of user study evaluation for YAGO image generation.

2 Details of Generation Quality

We provide more examples of generated samples for movie titles (for MovieLens) in Table 1 and generated YAGO descriptions in Table 2. Screenshots of the user studies for image and text generation on YAGO dataset is provided in Figure 1 and 2.

Table 1: Generated movie titles for MovieLens dataset.

Reference	Model R+M+U+T+P	Model R
Amityville 3-D (Horror)	Creatures	Swimming
The Gay Divorcee (Romance/Musical)	Taste Condition	Crossfire Water
Jury Duty (Comedy)	Nixon World	Angels Lay
Turbulence (Thriller)	Assignment	Drum
The Butcher Boy (Drama/Thriller)	Steel Roof	Killing Crazy Woman
Mortal Kombat: Annihilation (Action/thriller)	The Cop Witness	Double Game
Glengarry Glen Ross (Drama)	Farewell of Fugitive	Offerings to Strange
Nightwatch (Fantasy/Thriller)	Lawrence Escape	Beyond Victor/Victoria
Balto (Children's/Comedy)	Innocent Army	The Umbrella Man
Home Alone 3 (Comedy/Crime)	The Rainmaker	Angels Lay
Jason's Lyric (Crime/Drama)	Wooden Beast	Minds Deal

Table 2: Generated descriptions for YAGO dataset.

Reference	Model S+N+D+I	Model S
⟨subject⟩ (born 29 July 1911) was an American actor remembered mostly for his appearances in many westerns and action films.	⟨subject⟩ (born December 27, 1986) is an American actress.	⟨subject⟩ (born November 4, 1975) is an <oov> singer-songwriter.
⟨subject⟩ (born 1 March 1993) is a Spanish footballer who plays for German club FC Bayern Munich mainly as a left back but also as a left winger.	⟨subject⟩ (born 13 January 1976) is a retired Belgian football player and the goalkeeping coach of A-League RB Ecuador, United.	⟨subject⟩ (born 13 June 1959) is a former professional football player and coach.
⟨subject⟩ (born 5 March 1979) is a former Singapore international footballer who currently plays for Geylang International as a forward .	⟨subject⟩ (born on 8 April 1985) is an Israeli footballer currently playing for Wehen Barcelona.	⟨subject⟩ (4 May 1989) is an Iranian footballer playing for Hardy, 2.
⟨subject⟩ (born October 11, 1985) is an American actress.	⟨subject⟩ (born November 17, 1966) is an English actress and record producer.	⟨subject⟩ (born 1963) is an American actor, and film director.

Figure 2: Screenshot of user study evaluation for YAGO text generation.