Understanding Actors and Evaluating Personae with Gaussian Embeddings

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persona

a class of story characters that share traits, behaviors, and motivation.

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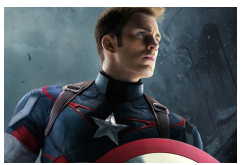
a class of story characters that share traits, behaviors, and motivation.

The hero



The mentor

The Villain

Models for Learning Character Types

[...] When **he** *was an infant*, the evil **Lord Voldemort** *killed* his parents and then tried to *kill* **Harry** too. **Harry** *survived*, and allegedly *destroyed* **Voldemort** in the process. [...]

From the Harry Potter and the Sorcerer's Stone page of WikiSummaries

Bamman, O'Connor, and Smith. ACL 2013
Learning latent personas of film characters.

Bamman, Underwood, and Smith. ACL 2014
A bayesian mixed effects model of literary character.

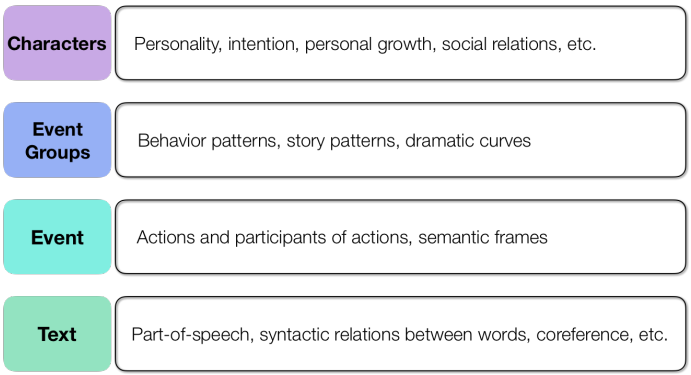
Chaturvedi, Iyyer, and Daume III. AAAI 2017
Unsupervised learning of evolving relationships between literary characters.

Learn persona as a group of *topics* over action verbs, possessives, and modifiers.

E.g., a hero often rescues and a villain tends to kill.

Challenges of Narrative Understanding

✕ Multiple facets entangled



How to jointly model multiple facets?

✕ Lack of automatic evaluation methods

E.g., Expert surveys,
crowdsourcing, etc

What are effective, automatic evaluation methods?

Our Idea – “actors”

Actors and the **characters** they play are correlated.

Arnold Schwarzenegger: tough guy, warrior

Helena Bonham Carter: quirky, dark, eccentric

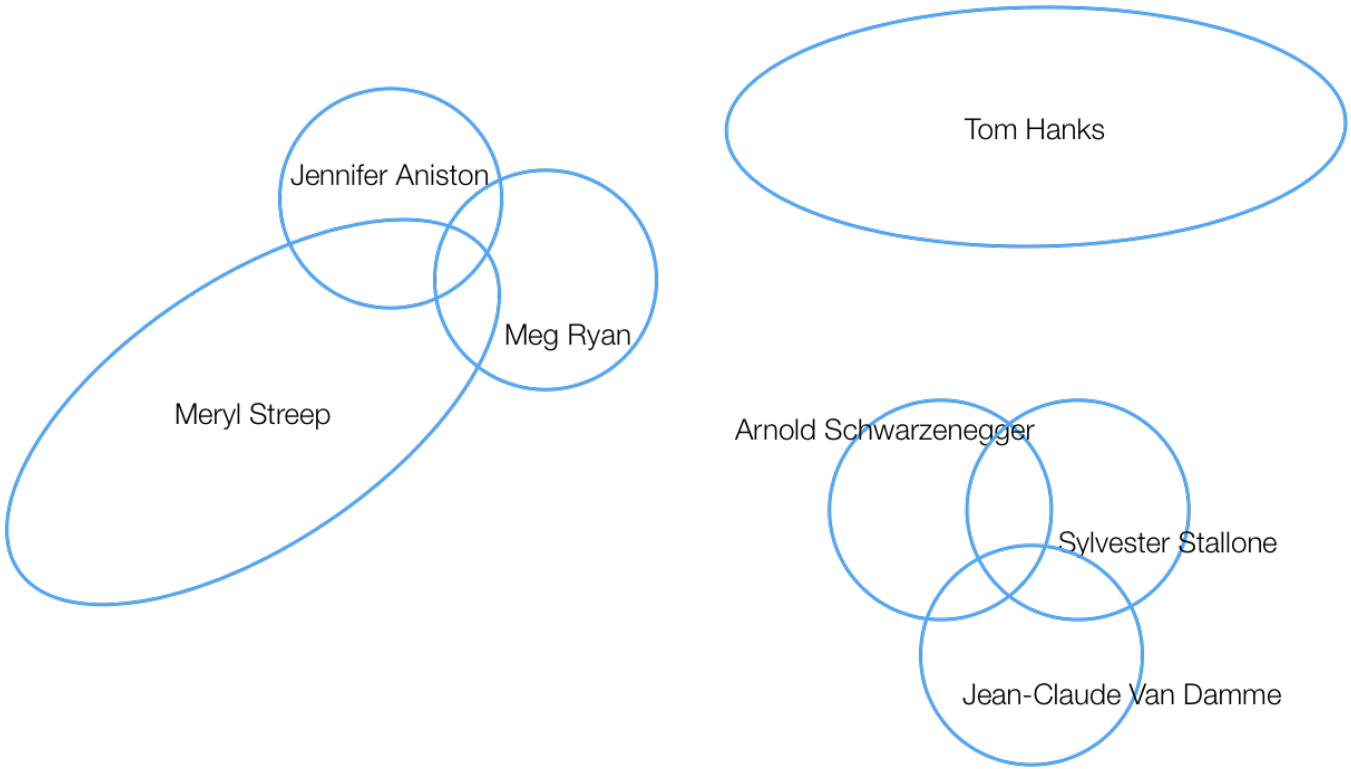
A good list of personae should facilitate the modeling of actors.

Our Idea: Modeling actors

- ✓ Helps character understanding
- ✓ Introduces **two evaluation metrics for modeling personae**: *cast prediction* and *versatility ranking*
- ✓ Can benefit downstream applications such as content recommendation

Actor Gaussian Embedding

Embed an actor as a Gaussian $\mathcal{N}(\mu^a, \Sigma^a)$

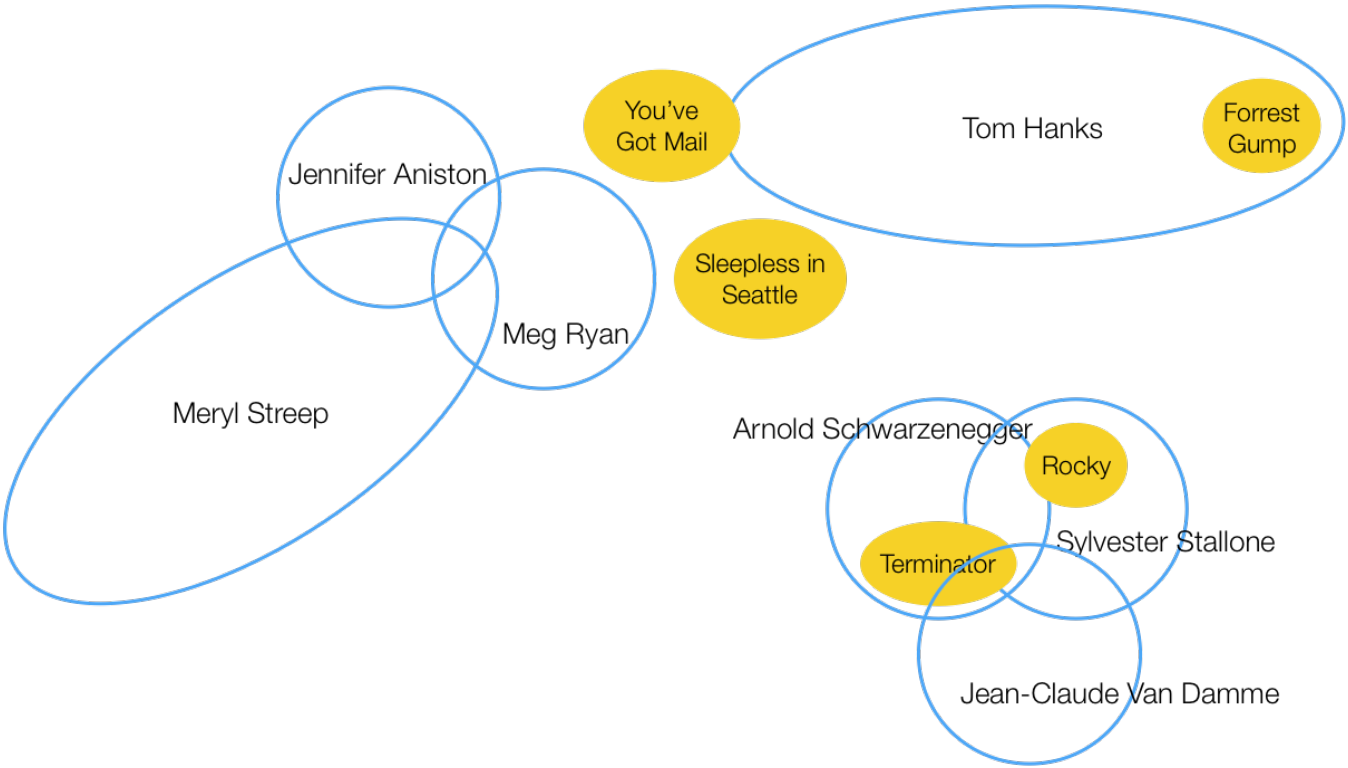


Why Gaussian ?

- ✓ Gaussian models the **inherent uncertainty**.
- ✓ Represent actors' versatility as variance.
- ✓ Casting decision is influenced by random events such as schedule conflicts and actor injuries.
- ✓ The meaning of keywords is subject to users' interpretation.

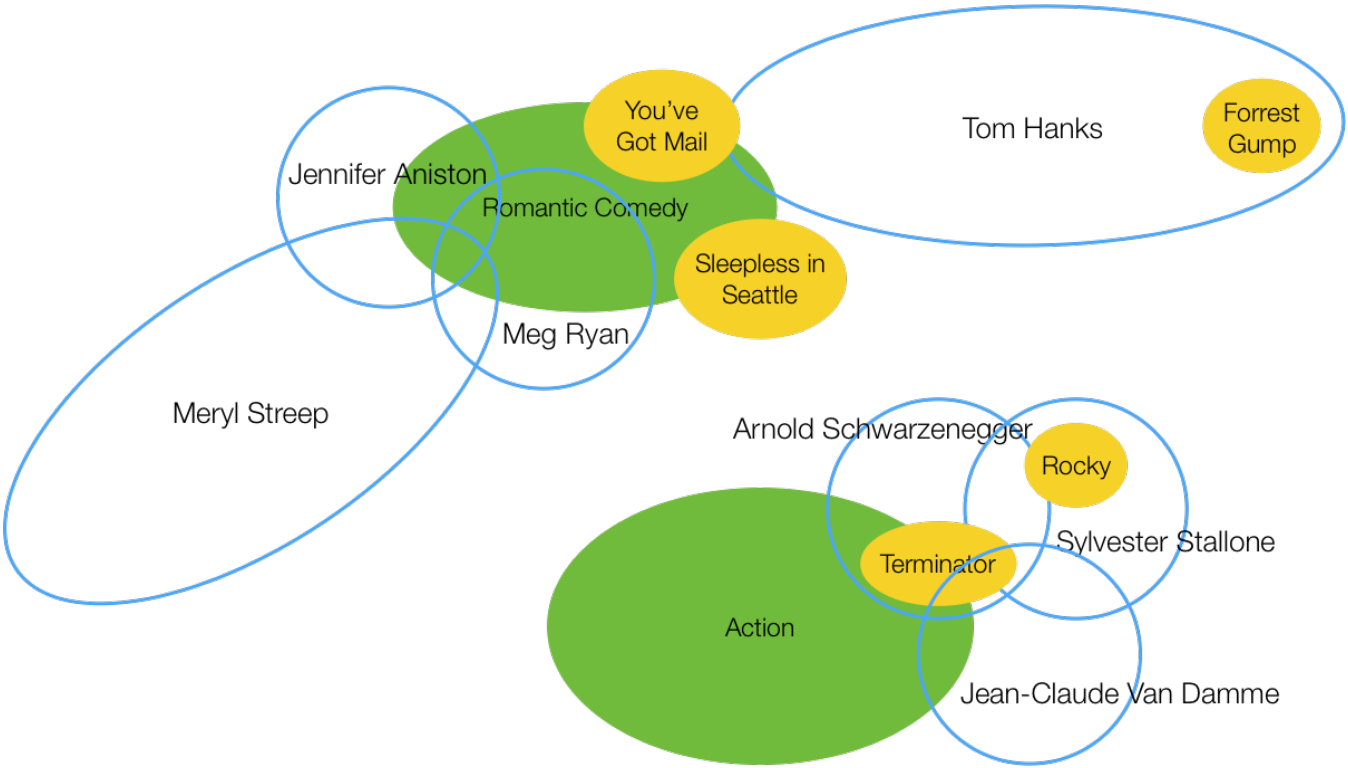
Actor (and Movie) Gaussian Embedding

Embed a movie as a Gaussian $\mathcal{N}(\mu^m, \Sigma^m)$ to anchor actors



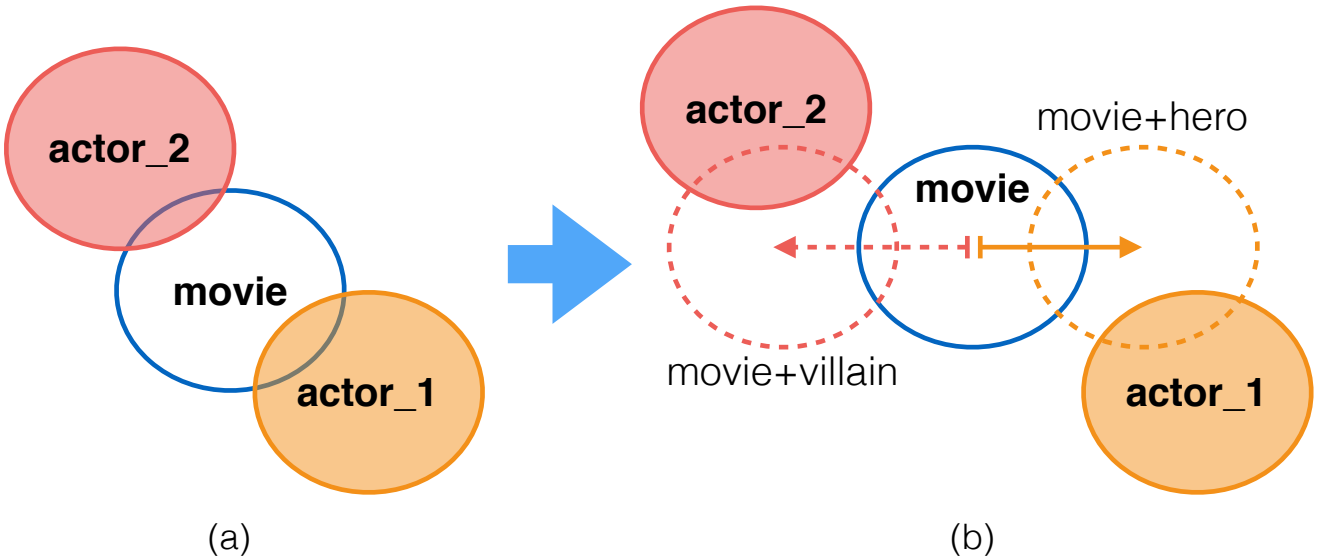
Actor, Movie (and Keywords) Gaussian Embedding

Embed a keyword as a Gaussian $\mathcal{N}(\mu^k, \Sigma^k)$ to anchor movies



Persona Translation Vector

Distinguish different actors in the same movie



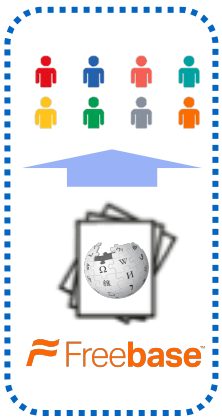
Dataset

persona
<movie, ~~character,~~ actor> <movie, keyword>

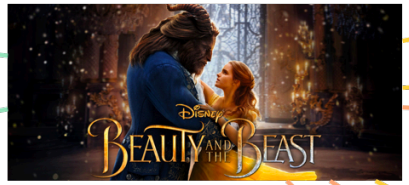
3.3K Actors | 11.6K Character | 15K Movies | 20 Genres | 3.5K Keywords

Bell
→ **Persona Type 1**

LeFou
→ **Persona Type 2**



11.6K Personae



- Romance
- Family
- Action
- Horror
- Fantasy
- Adventure

- betrayal
- held_captive
- superhero_team
- love_of_one_s_life
- wooden_eye
- fairy_tale
- job_interview
- musical
- caribbean

Dataset - Persona

<movie, persona, actor>

(age, gender, topic)

WIKIPEDIA

Movie plot summaries

Topic persona

(Bamman et al. 2013)

Freebase™

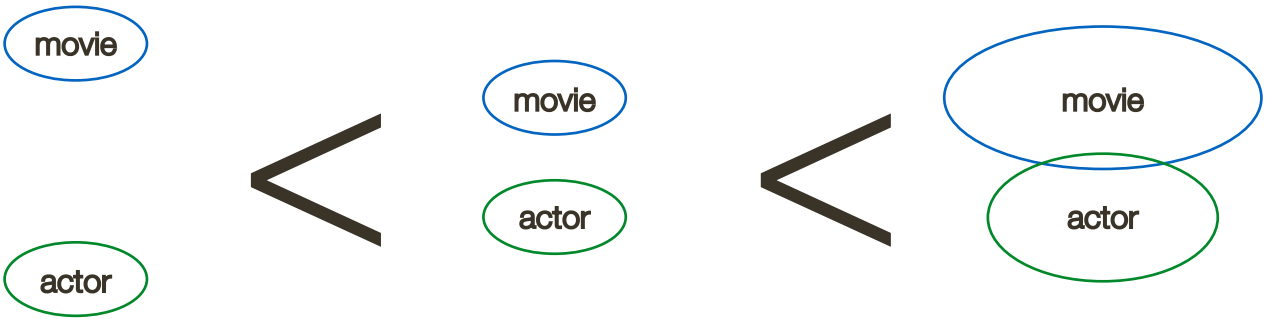
Actor age, gender

= Character age, gender

Actor2Gauss

The similarity between <movie, actor> is

$$\text{Similarity}(\text{m}, \text{a}) = \log \mathcal{N}(\mu^m - \mu^a, \Sigma^m + \Sigma^a)$$



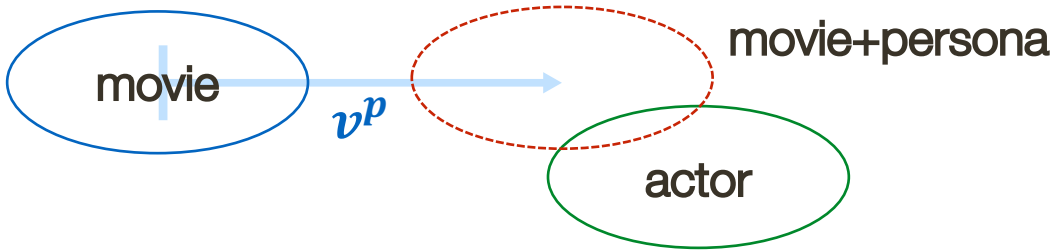
The similarity between <movie, keyword> is

$$\text{Similarity}(\text{m}, \text{k}) = \log \mathcal{N}(\mu^m - \mu^k, \Sigma^m + \Sigma^k)$$

Actor2Gauss + Persona

The similarity between <movie, **persona**, actor> is

$$\text{Similarity}(\text{m}, \mathbf{p}, \text{a}) = \log \mathcal{N}((\mu^m + \boldsymbol{v^p}) - \mu^a, \Sigma^m + \Sigma^a)$$



We train the model using negative sampling.

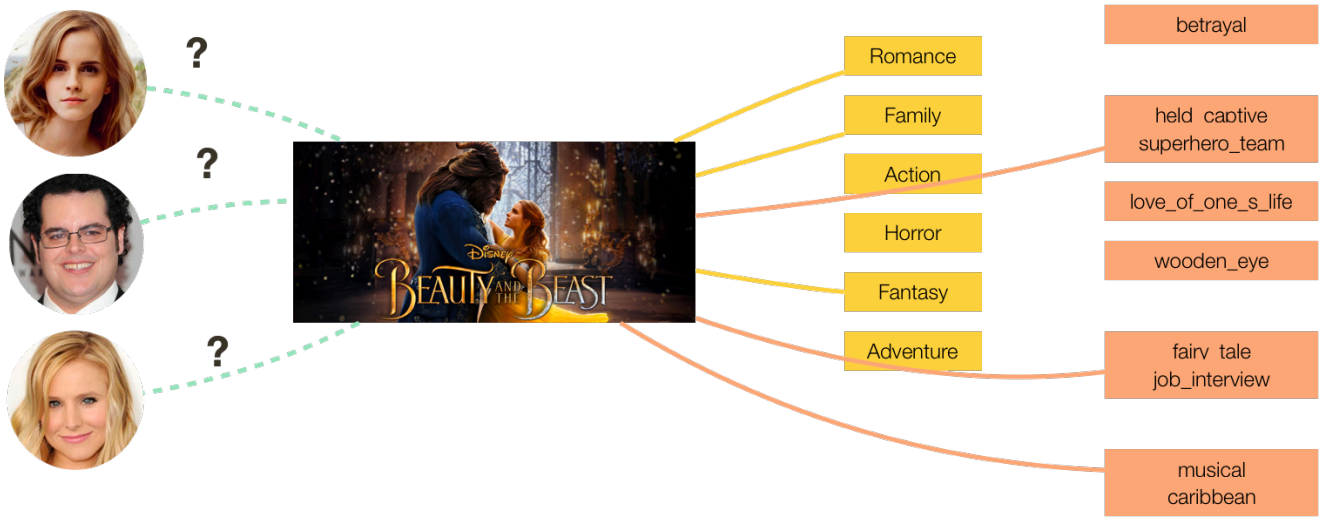
$$\mathcal{L}_{mpa} = \sum_{\langle m_i, p_i, a_i \rangle \in \mathcal{D}_{mpa}} \mathop{\mathbb{E}}_{a^- \neq a_i} [\![g(S(m_i, p_i, a_i), S(m_i, p_i, a^-))]\!]$$

$$\mathcal{L}_{mk} = \sum_{\langle m_i, k_i \rangle \in \mathcal{D}_{mk}} \mathop{\mathbb{E}}_{k^- \neq k_i} [\![g(S(m_i, k_i), S(m_i, k^-))]\!]$$

$$g(s_1, s_2) = \max(0, \phi - s_1 + s_2)$$

Evaluation Metric: Cast Prediction

Can we predict which actor played a character in a movie?



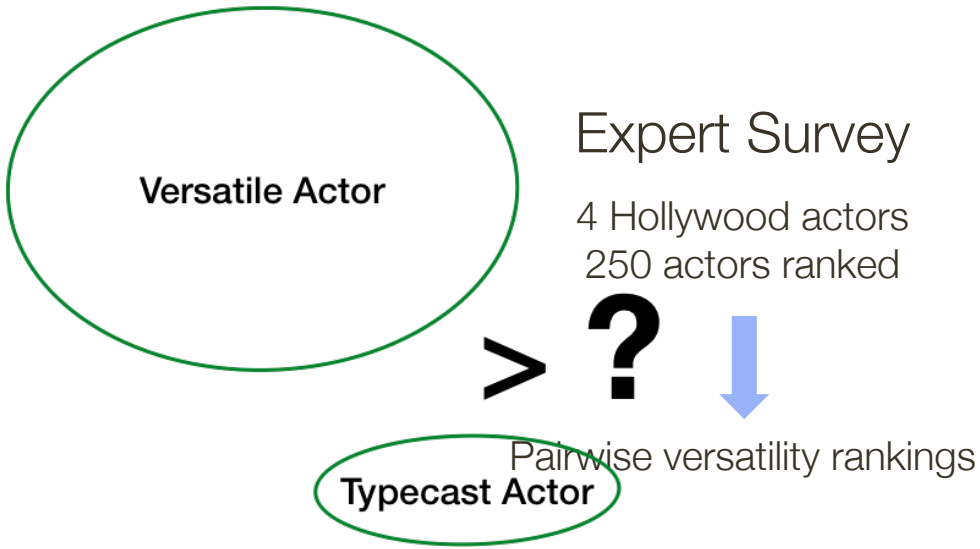
Results: Casting Prediction

- ✓ Significant performance improvement over TransE.
- ✓ Age and gender doubles accuracy.
- ✓ Good understanding of character persona can improve the performance.

	Mean Rank	Hits@10
(1) TransE	506.75	3.73 %
(2) JGE	479.59	6.17 %
(3) ...+GloVe	478.48	6.12 %
(4) JGE+T	479.66	6.23 %
(5) ...+GloVe	471.99	6.13 %
(6) JGE+AG	176.66	12.52 %
(7) ...+GloVe	176.77	**12.69** %
(8) JGE+AGT	**174.64**	12.54 %
(9) ...+GloVe	175.48	12.63 %

Evaluation Metric: Actor Versatility

Can our Gaussian Σ capture how versatile an actor is?



Results: Actor Versatility Ranking

- ✓ 59.72% agreement with human expert ranking.
- ✓ Age and gender hurts performance, indicating less correlation with actor skills.
- ✓ The 1st successful attempt at predicting actors' versatility.

	Val. Acc. (%)	Test Acc. (%)	Test Rank Corr.
Genre	42.72	45.60	-0.082
Keyword-Topics	34.74	39.78	-0.192
PTG	43.48	43.14	-0.196
JGE	47.77	55.13	0.070
... +Glove	46.71	55.06	0.072
JGE+T	61.78	**59.72***	0.163*
... +Glove	62.30	59.39*	**0.165***
JGE+AG	56.95	50.84	0.059
... +Glove	58.05	52.95	0.084
JGE+AGT	56.22	50.57	0.043
... +Glove	55.33	50.53	0.039

Persona Evaluation Metrics

We proposed two actor modeling tasks: *casting prediction* and *versatility ranking*.

(Automatically identified) **persona topics** lead to statistically significant improvements in both tasks. Whereas **simple persona descriptors** such as age and gender perform inconsistently.

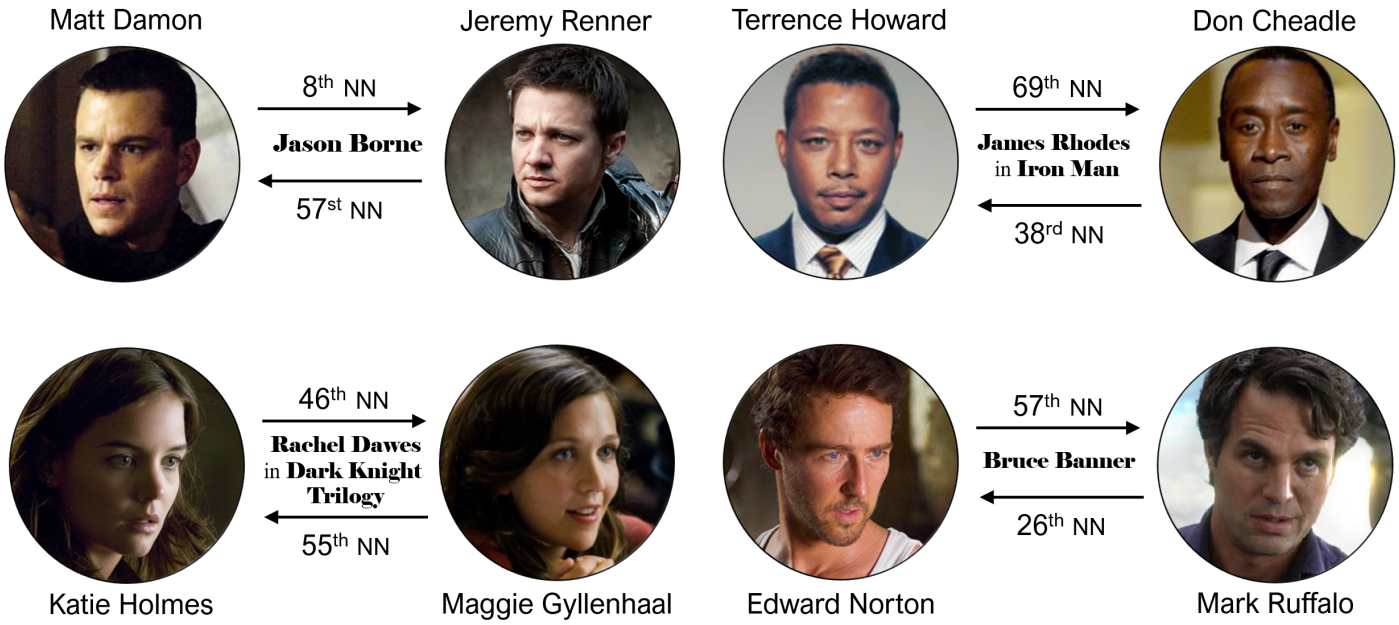
The tasks offer complementary evaluation metrics for persona models.

Research on persona identification is still in an early stage. We believe this paper can aid further advancement on narrative understanding.

Qualitative: Actor Substitution

Actors are replaced during casting, filming, in sequels/reboots.

Are replaced actors similar in terms of nearest neighbors?



Understanding Actors and Evaluating Personae with Gaussian Embeddings

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Our joint Gaussian embedding for movies, actors, and persona

- ✓ Models semantic uncertainty and actor versatility
- ✓ Provides automatic evaluation methods for persona models

Model & data available at https://github.com/hannah-kim/actor2gauss