Monte Carlo Semantics

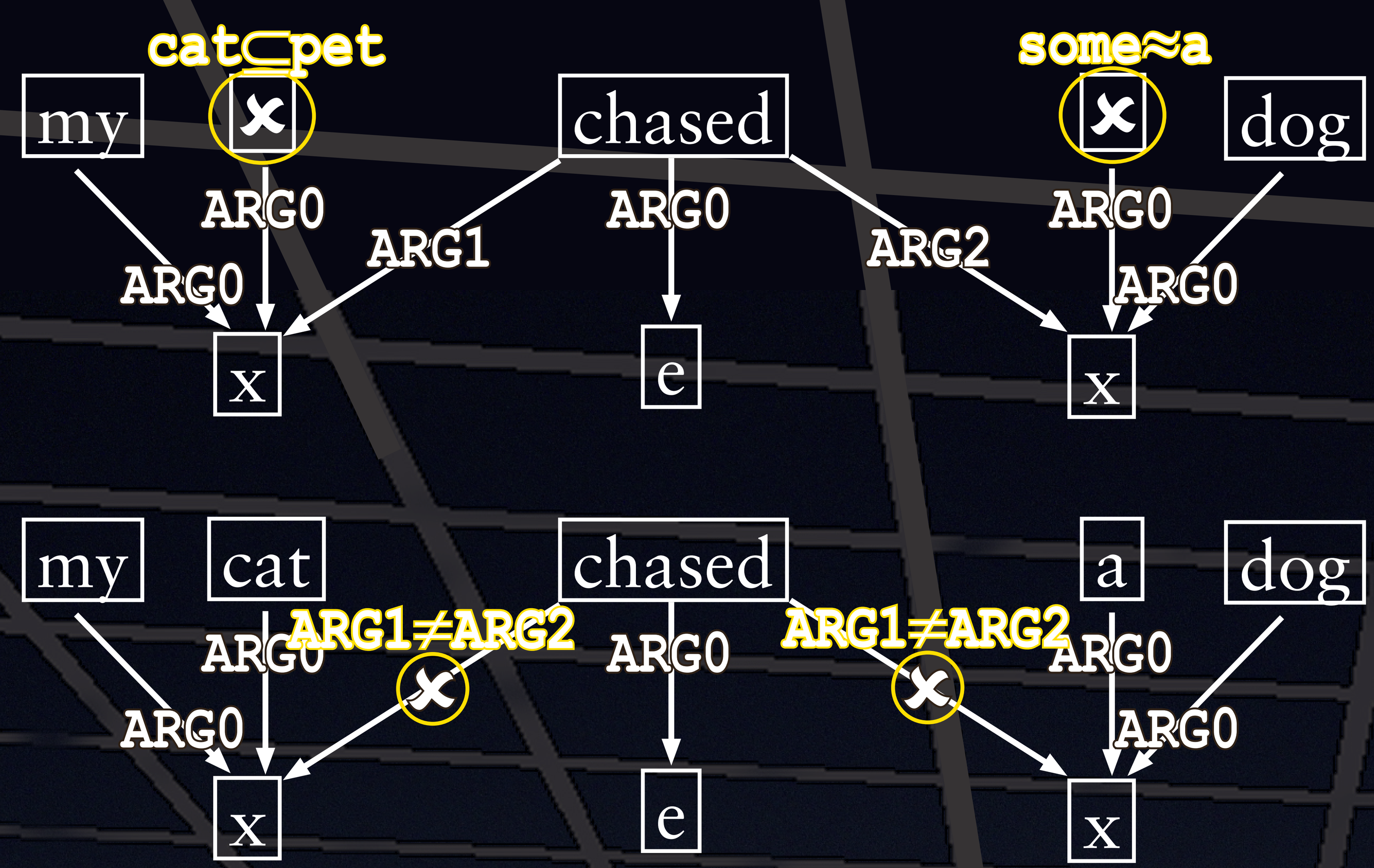
Robust Text Inference and Logical Pattern Recognition Based on Integrated Deep and Shallow Semantics

Information Retrieval

- ✓ *Cambridge*
- ✗ *the university near the Town of Cambridge*
  the town near the University of Cambridge
- ✗ *the famous old university at the river on the island northwest of the continent*
- ✓ *Star Trek VII movie review*
- ✗ *Star Trek VII positive opinions*

...semantically aware language processing is all about getting these right.

Symbolic RMRS Comparison



...but there are problems with these:

Socrates is a man and every man is mortal.

∴ Socrates is mortal.

It is false that Socrates is mortal.

∴ It is true that Socrates is mortal.

U.N. general secretary Kofi Annan visited Baghdad early this week.

∴ Kofi Annan is the general secretary of the U.N.

Monte Carlo Semantics

generate a random possible world, by assigning random truth values to predicates

x	white(x)	cat(x)	black(x)	dog(x)
1	.74	.53	.39	.97
2	.15	.9	.85	.57
3	.83	.27	.34	.9
4	.4	.18	.95	.61
5	.13	.05	.54	.27

chase(x, y)	1	2	3	4	5
1	.99	.19	.65	.3	.6
2	.99	.3	.27	.98	.69
3	.63	.52	.48	.25	.87
4	.23	.45	.43	.32	.9
5	.67	.17	.17	.66	.81

determine the degree of fulfillment of some formulae in this random model:

$$p : \mathrm{SOME}\{\ x_{10},\ \mathrm{white}(x_{10}) \wedge \mathrm{cat}(x_{10}),\ \mathrm{EVERY}\{\ x_4,\ \mathrm{black}(x_4) \wedge \mathrm{dog}(x_4),\ \mathrm{chase}(x_4, x_{10})\ \}\ \} = .39$$

$$q : \mathrm{SOME}\{\ x_4,\ \mathrm{cat}(x_4),\ \mathrm{SOME}\{\ x_9,\ \mathrm{dog}(x_9)\ \mathrm{chase}(x_4, x_9)\ \}\ \} = .51$$

$$.39 \rightarrow .51 = .61$$

...average across different random models, while taking into account constraints from ontological domain knowledge

$\forall x{:}\mathrm{black}(x) \equiv \neg \mathrm{white}(x)$

```
black(x) := rand(0,1);
white(x) := 1 - black(x);
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$\forall x{:}\mathrm{cat}(x) \rightarrow \mathrm{pet}(x)$

$\forall x{:}\mathrm{dog}(x) \rightarrow \mathrm{pet}(x)$

```
pet(x) := rand(0,1);
cat(x) := rand(0,pet(x));
dog(x) := rand(0,pet(x));
```

questions? comments?

...looking forward to hearing them!

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