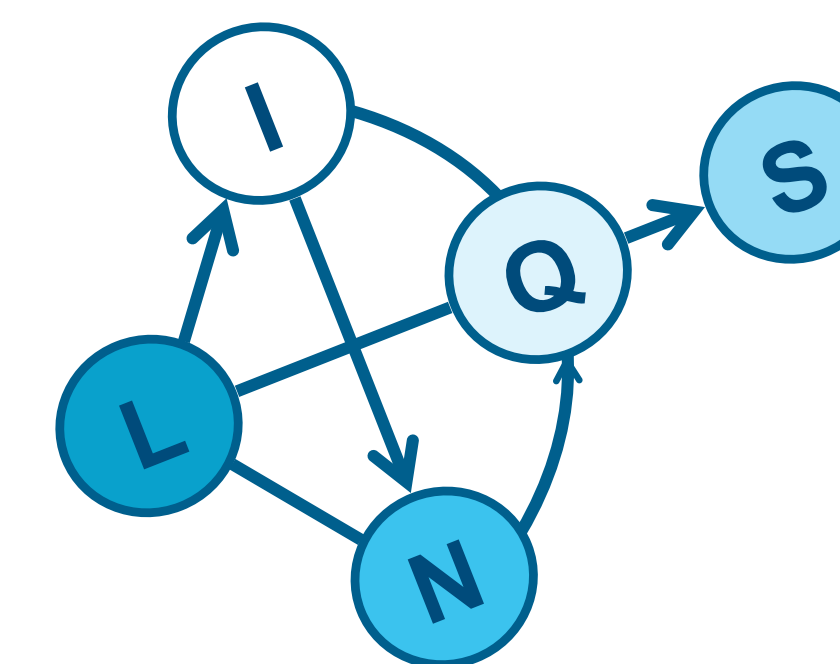


Probabilistic Soft Logic for Social Good

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Introduction to PSL

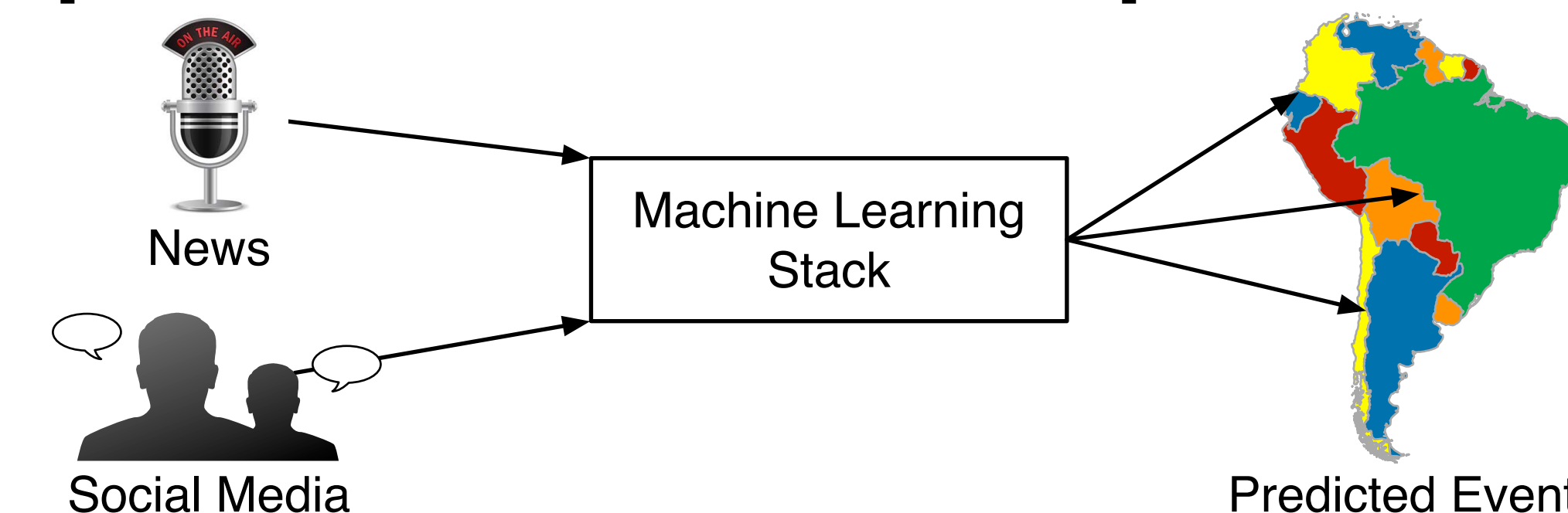
- **Big graph data** has numerous **social-good** applications
- Probabilistic soft logic (PSL) is a **declarative language** for defining probabilistic models over big data sets, such as socio-behavioral graphs [Bach et al., UAI 2013; Bröcheler et al., UAI 2010]
- PSL makes important **relational tasks** in social-good applications easier, such as collective classification, link prediction, and entity resolution

PSL Features

- **Intuitive, logic-based syntax**, which makes defining relational models easy
- **Highly scalable reasoning** using convex optimization techniques such as the alternating direction method of multipliers (ADMM)
- Support for learning with **latent variables**
- New **distributed GraphLab** inference [Miao et al., Intl. Conf. on Big Data 2013]

Real-World Applications of PSL

- Predict **disease outbreaks** and **civil unrest** from news and social media [Ramakrishnan et al., KDD 2014]
- Model **student engagement** in massive open online courses (**MOOCs**) as **latent variables** in order to **predict outcomes** [Ramesh et al., AAI 2014]



Example PSL Program for Disease-Outbreak Detection Using Social Media

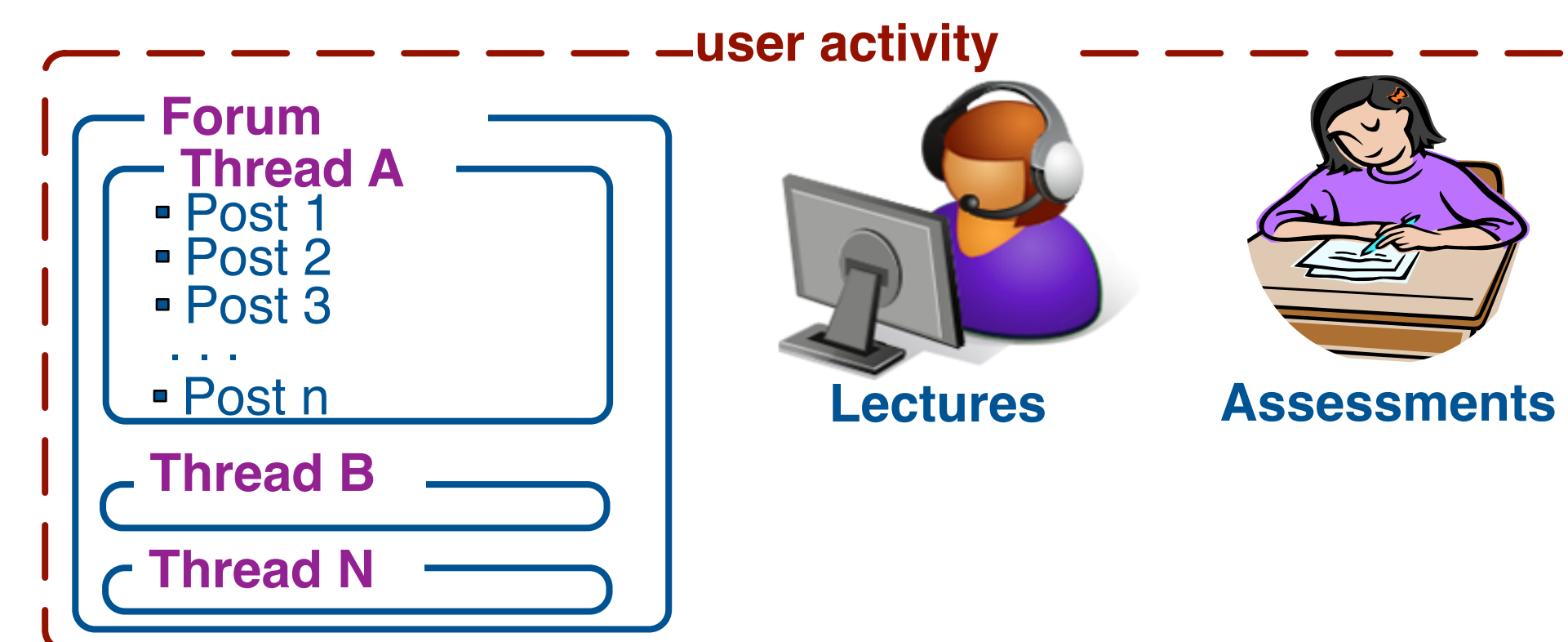
```

/* Defines predicates */
HasDisease(Location, Disease)
HasLocation(Post, Location)
MentionsEntity(Post, Entity) (closed)
IsLocation(Entity) (closed)
IsDisease(Entity) (closed)
IsGeotagged(Post, Geotag) (closed)
InLocation(Geotag, Location) (closed)
Nearby(Location, Location) (closed)

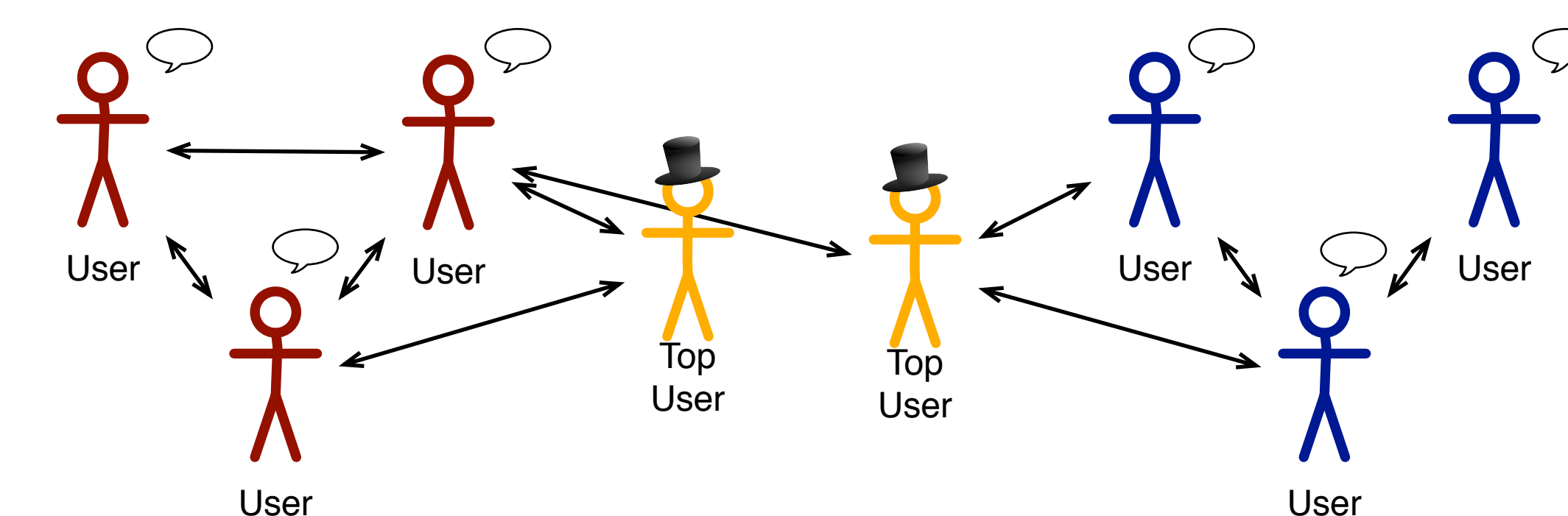
/* Defines subtype relationships */
Location is a Entity
Disease is a Entity

/* Infers locations of posts from location mentions */
2.0 : MentionsEntity(P, E) && IsLocation(E) -> HasLocation(P, E)
/* Uses any available geotags as strong evidence for determining a post's location */
10.0 : IsGeotagged(P, G) && GeotagInLocation(GT, L) -> HasLocation(P, L)
/* Infers disease presence from disease mentions */
5.0 : MentionsEntity(P, E) && IsDisease(E) -> HasDisease(P, E)
/* Infers disease presence from nearby locations */
1.0 : HasDisease(L1, D) && Nearby(L1, L2) -> HasDisease(L2, D)
/* Requires sufficient evidence in order to infer disease presence */
0.5 : !HasDisease(L, D)
    
```

**Open-source
implementation and
video tutorials available
at PSL's website!**



- Identify **latent groups** in social media [Bach et al., Inferring Workshop 2013]



- Predict **trust** in social networks [Huang et al., SBP 2013]



Learn more: <http://psl.cs.umd.edu>