

Using a DL reasoner to assist SNOMED CT authoring with real-time results

Dr. Guillermo Reynoso

Dr. Alejandro Lopez Osornio

Using DL in SNOMED CT (batch mode)

- Editing the Stated form
- Request a classification
- Wait a few minutes
- Check results
 - New inferred supertypes
 - New inferred subtypes
 - Inherited attributes (distribution normal form)
 - Equivalences



Authoring challenges

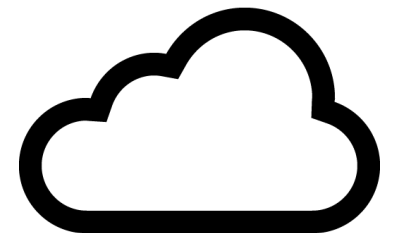
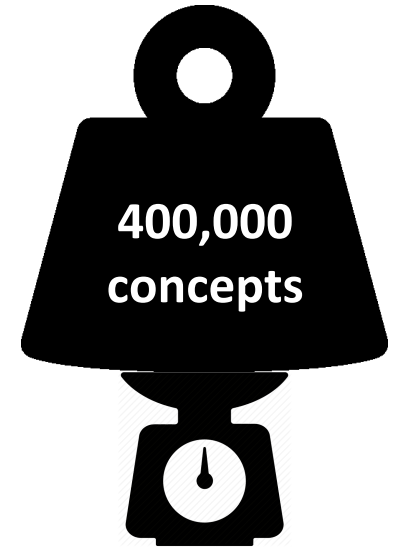
- Late detection of equivalences
- Workflow disruptions
- Difficult estimation of consequences of actions
- Complex debugging of attribute inheritance on distribution normal form
- Lack of explanations for classifier inferences complicates debugging
- Learn from errors



Technological challenges

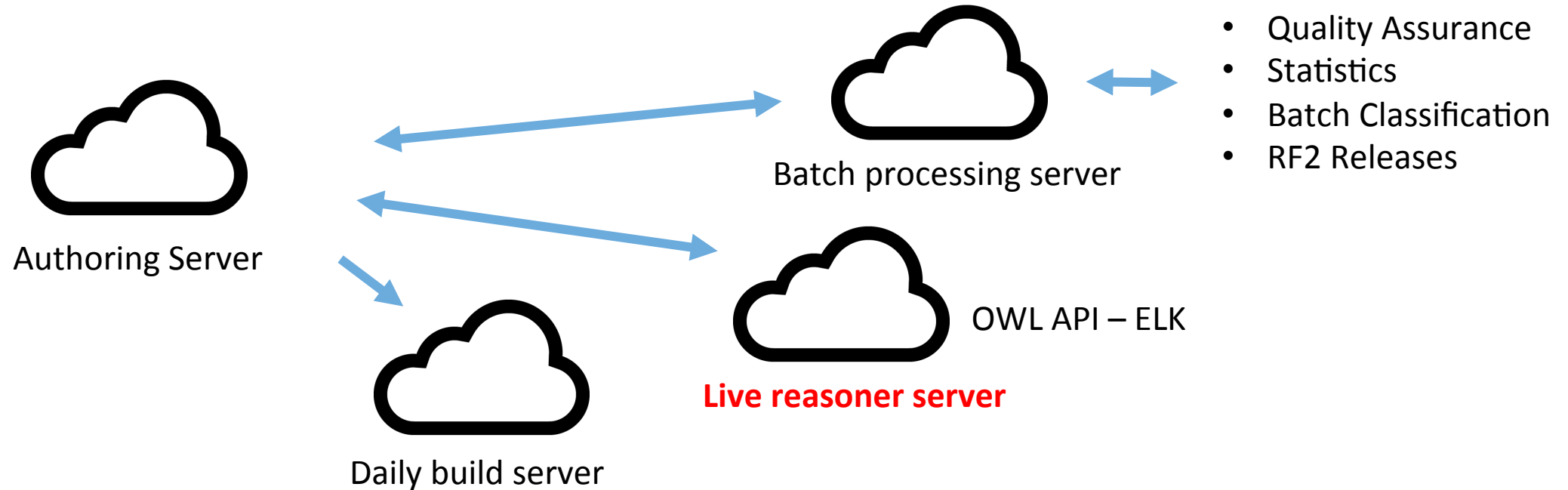
- The size of SNOMED CT has been an obstacle for implementing instant classification
 - Demands on memory, computer power
 - Write-back time
- Incremental classification availability
- Desktop vs Web based environments
- Support for branching and versioning

...new cloud based paradigms provide new possibilities



termSpace

- A web based Authoring environment for SNOMED CT Extensions
- Services oriented architecture



Supporting authors

- **Objective:** to eliminate the wait to see classification results
- Every time the concept definition is changed (Stated view)
 - All super-types are inferred
 - All sub-types are inferred
 - Equivalences are detected and reported
 - Inherited relationships are computed
 - An up-to-date ancestors graph is available
 - Entailments "explanations" can be computed



[Details](#)[Designation](#)[Definition](#)[Authoring Support](#)[Diagram](#)[Expression](#)[OWL](#)[Refsets](#)[Members](#)[References](#)[History](#)[Graph](#)

Colon resection (procedure)

[View inferred hierarchy graph](#)

SCTID: 941234567107

The ontology is consistent and satisfiable

Equivalentents (2)

- Colectomy (procedure)
- Colon resection (procedure)

Superclasses (2)

[All Superclasses \(34\)](#)

- Partial excision of large intestine (procedure)
- Operation on colon (procedure)

Subclasses (16)

[All Subclasses \(103\)](#)

- Total colectomy (procedure)
- Sigmoidoscopy and excision of mucosa of sigmoid colon (procedure)
- Partial resection of colon (procedure)

Why Colon resection (procedure) is a subtype of Partial excision of large intestine (procedure)

Colon resection (procedure) \sqsubset Partial excision of large intestine (procedure)

Colon resection (procedure) \equiv Procedure (procedure) \cap (\exists Role group.(\exists Method (attribute).Excision - action (qualifier value)) \cap (\exists Procedure site - Direct.Colon structure (body structure))))

Excision - action (qualifier value) \sqsubset Surgical removal - action (qualifier value)

Surgical removal - action (qualifier value) \sqsubset Surgical action (qualifier value) \cap Removal - action (qualifier value)

Removal - action (qualifier value) \sqsubset Action (qualifier value)

Colon structure (body structure) \sqsubset Large intestine part (body structure)

Excision (procedure) \equiv Procedure by method (procedure) \cap (\exists Role group.(\exists Method (attribute).Excision - action (qualifier value)))

Procedure by method (procedure) \equiv Procedure (procedure) \cap (\exists Role group.(\exists Method (attribute).Action (qualifier value)))

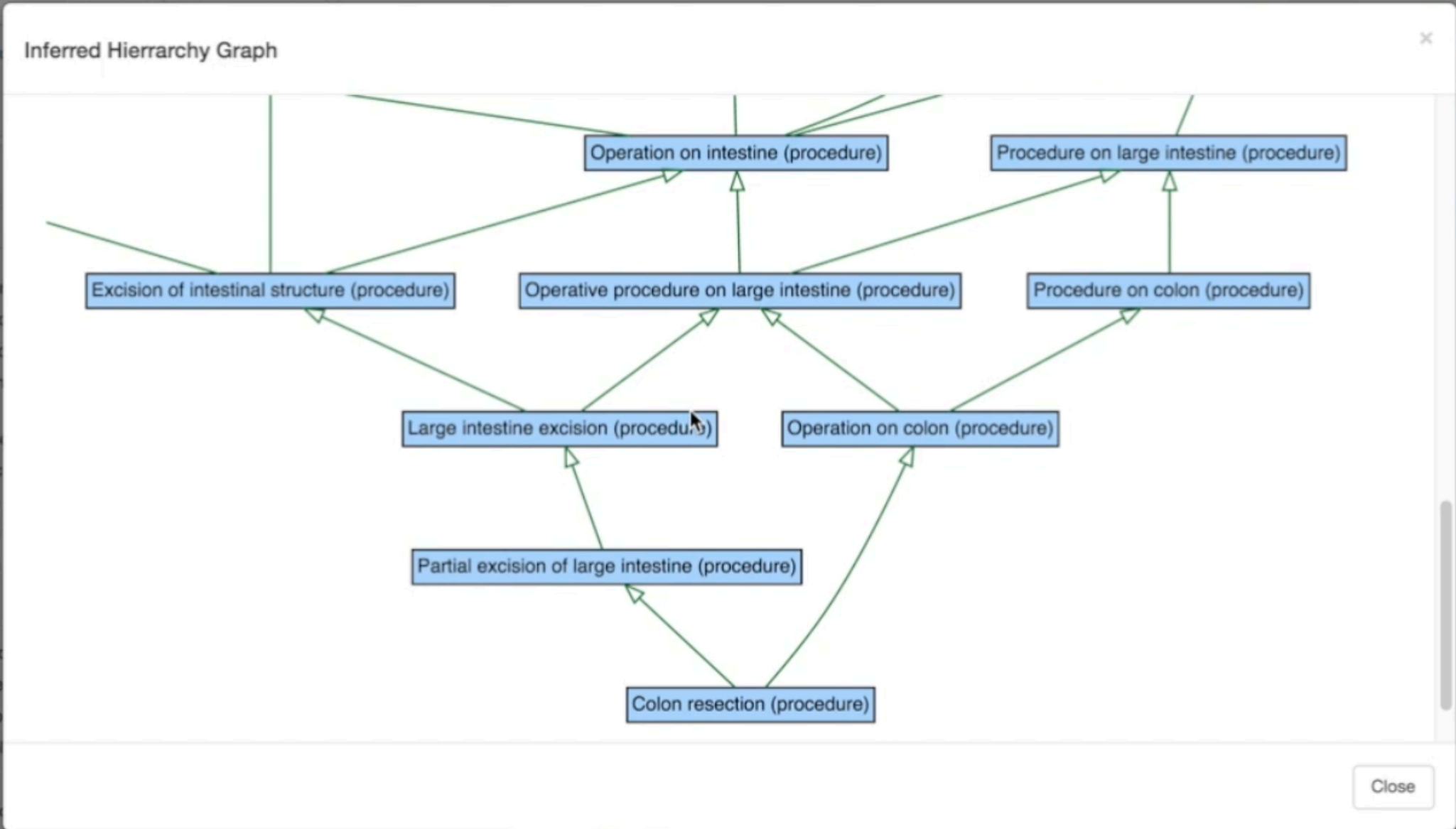
Partial excision of large intestine (procedure) \equiv Excision (procedure) \cap (\exists Role group.(\exists Method (attribute).Excision - action (qualifier value)) \cap (\exists Procedure site - Direct.Large intestine part (body structure))))

Use verbose explanation | Show Ids | Close

- Taxonomy
- Classifier
- Taxonomy
- Inferred view
- Partial excision
- Operation on c
- Colon resect
- Colectom
- Colonos
- Epipl
- Excision of colonic pouch (procedure)
- Excision of lesion of colon (procedure)
- Excision of part of colon with mobilization of splenic flexure (procedure)
- Ileocolic resection (procedure)
- Laparoscopic excision of part of colon (procedure)
- Partial resection of colon (procedure)
- Resection of colon for interposition (procedure)
- Right colectomy (procedure)
- Sigmoid colectomy (procedure)
- Sigmoidoscopy and excision of mucosa of sigmoid colon (procedure)
- Total colectomy (procedure)
- Transverse colectomy (procedure)

- Partial resection of colon (procedure) ?
- Epipl
- Laparoscopic excision of part of colon (procedure) ?
- Sigmoid colectomy (procedure) ?
- Ileocolic resection (procedure) ?
- Wedge resection of colon (procedure) ?
- Excision of part of colon with mobilization of splenic flexure (procedure) ?
- Resection of colon for interposition (procedure) ?
- Transverse colectomy (procedure) ?
- Colectomy and side to side anastomosis of ileum to colon (procedure) ?
- Excision of colonic pouch (procedure) ?
- Colonoscopy and excision of mucosa of colon (procedure) ?
- Excision of lesion of colon (procedure) ?
- Right colectomy (procedure) ?

- Partial excision of large intestine (procedure)
- Operation on colon (procedure)
- Colon resection (procedure)
 - Colectomy (procedure)
 - Colonoscopy (procedure)
 - Epiploectomy (procedure)
 - Excision of intestinal structure (procedure)
 - Excision of part of colon (procedure)
 - Excision of part of large intestine (procedure)
 - Ileocolic resection (procedure)
 - Laparoscopic excision of part of colon (procedure)
 - Partial resection of colon (procedure)
 - Resection of part of colon (procedure)
 - Right colectomy (procedure)
 - Sigmoid colectomy (procedure)
 - Sigmoid resection (procedure)
 - Total colectomy (procedure)
 - Transverse colectomy (procedure)

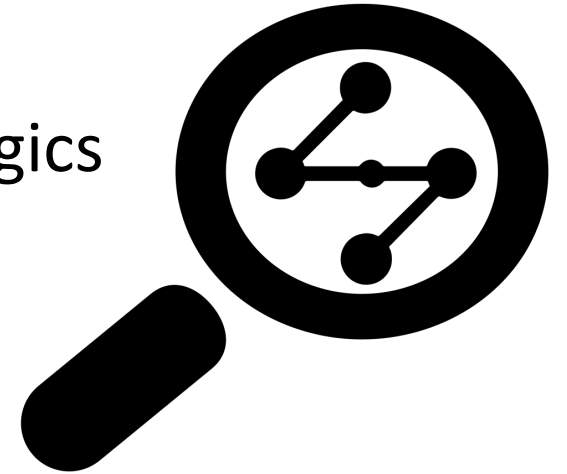


Close

Demo real-time authoring
support

Additional benefits

- Real-time *semantic queries* leveraging Description Logics
- Write a concept definition and get descendants:



```
404684003 |Clinical finding (finding)| :
```

```
246075003 |Causative agent (attribute)| = 387458008 |Aspirin (substance)|
```

```
118669005 |Procedure on respiratory system (procedure)| :
```

```
363704007 |Procedure site (attribute)| = 4596009 |Laryngeal structure (body structure)|
```

Demo DL queries

Ongoing challenges



- It's still resource intensive
- The classifier needs to be synchronized with the terminology content
- Complex to serve multiple paths (viewpoints)
 - Multiple virtual servers, automatic provision of new servers
 - Share servers and suffer a minor synchronization wait to start from baseline
- Display the cascading impact of a change in a particular concept

Thanks

greynoso@termmed.com

alopez@termmed.com

YouTube video: <https://youtu.be/xDi0NlcSEoM>