SCHEMA LEARNING IN APACHE SOLR

Abhishek Kumar Singh
Search Engineer, Unbxd

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About Unbxd

E-Commerce Search, Discovery and Recommendation

Agenda

- Motivation
- Objectives for a new solution
- Schema Learning Framework
- Inference Modes
    - Primitives/Regex
    - Model
- Conclusion
- Roadmap

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Motivation

We'll try to index the following 2 documents

	Title	Price	ProdId
Doc1	Deadpool 2	200	2017-03-01
Doc2	Fantastic Beasts	344.5	ssid-01-po

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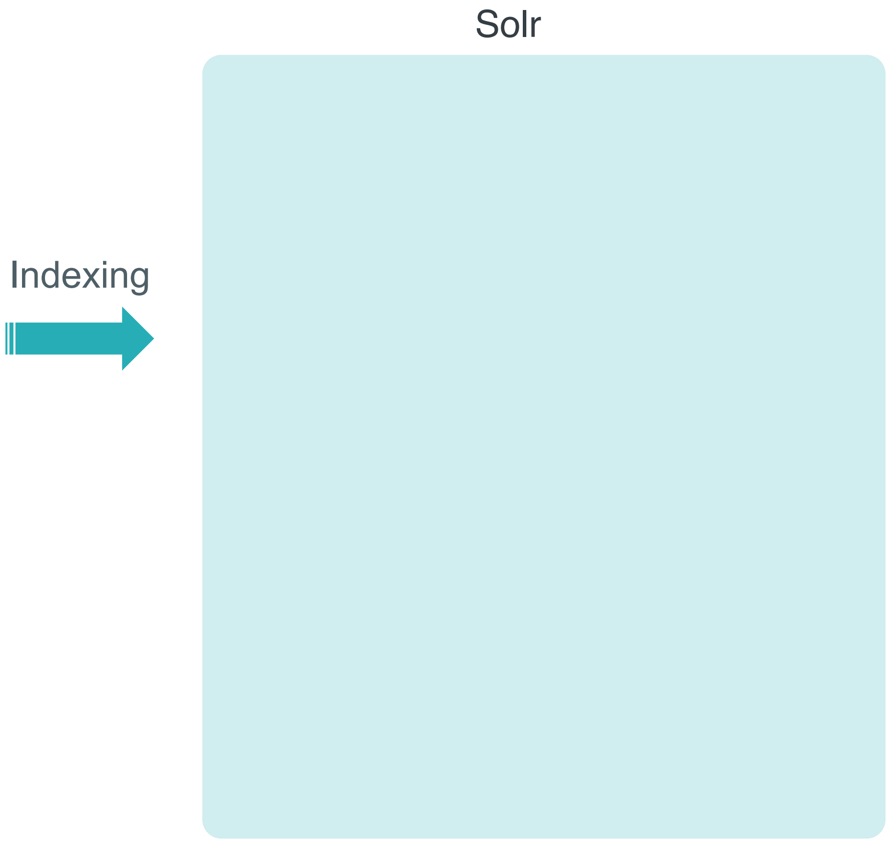
Motivation

Indexing 1st Doc:

	Title	Price	ProdId
Doc1	Deadpool 2	200	2017-03-01

	Title	Price	ProdId
Doc2	Beasts	178.77	ad23-33-a2



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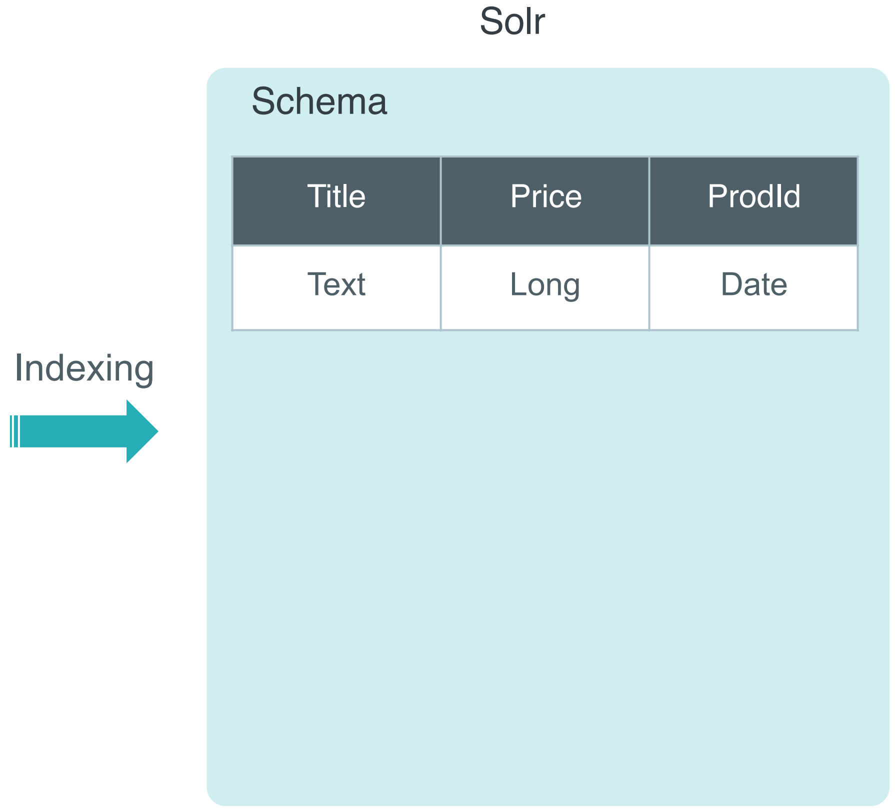
Motivation

Indexing 1st Doc:

Schema Inferred
Persisted to Managed Schema

	Title	Price	ProdId
Doc1	Deadpool 2	200	2017-03-01

	Title	Price	ProdId
Doc2	Beasts	178.77	ad23-33-a2



Title	Price	ProdId
Text	Long	Date

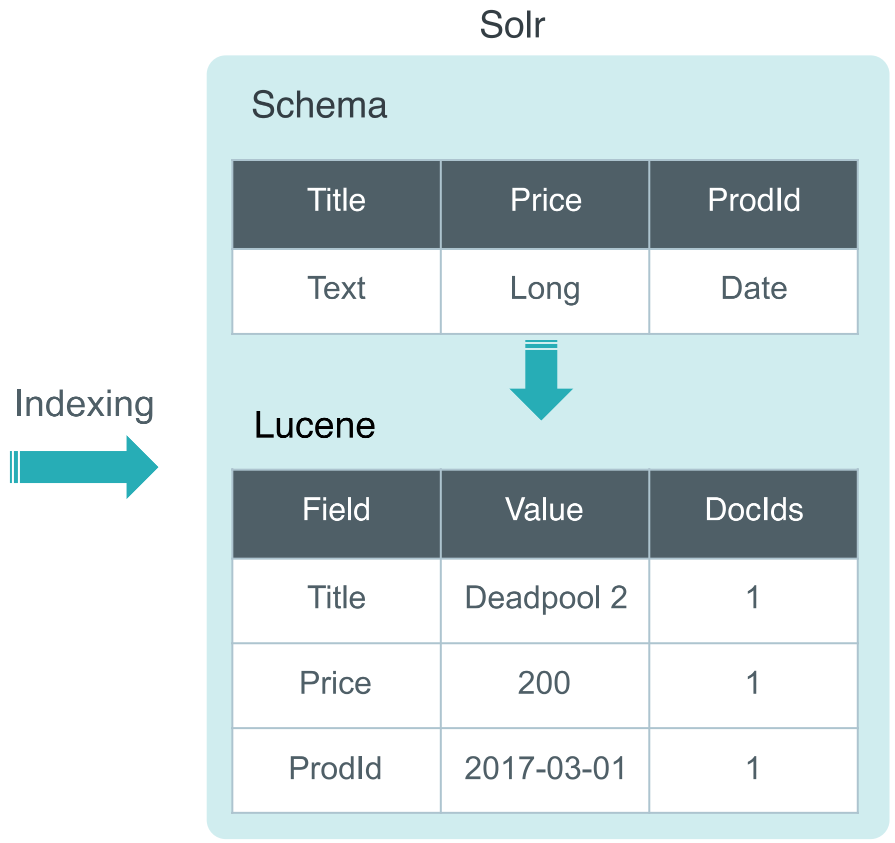
Motivation

Indexing 1st Doc:

Schema Inferred
Persisted to Managed Schema
Data Written to Lucene Index

	Title	Price	ProdId
Doc1	Deadpool 2	200	2017-03-01

	Title	Price	ProdId
Doc2	Beasts	178.77	ad23-33-a2



Title	Price	ProdId
Text	Long	Date

Field	Value	DocIds
Title	Deadpool 2	1
Price	200	1
ProdId	2017-03-01	1

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Motivation

Indexing 2nd Doc:

Validation with previous Schema

	Title	Price	ProdId
Doc1	Deadpo	200	2017-03-01

	Title	Price	ProdId
Doc2	Beasts	178.77	ad23-33-a2

Indexing →

Solr

Schema

Title	Price	ProdId
Text	Long	Date

Lucene

Field	Value	DocIds
Title	Deadpool 2	1
Price	200	1
ProdId	2017-03-01	1

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Motivation

Indexing 2nd Doc:

Validation with current Schema

-Validation Failed

	Title	Price	ProdId
Doc1	Deadpo	200	2017-03-01

	Title	Price	ProdId
Doc2	Beasts	178.77	ad23-33-a2

Indexing →

Solr

Schema

Title	Price	ProdId
Text	Long	Date

Lucene

Field	Value	DocIds
Title	Deadpool 2	1
Price	200	1
ProdId	2017-03-01	1

Error: **Schema Mismatch**

Expected Date Type in ProdId

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Objectives

- Data driven schema generation
  - Schema is tightly coupled with data

- Infer optimal types
  - Compatible with all the docs

- Semantic type inference
  - **For Fashion E-Commerce:** Indentifying color, pattern and title types from catalogs.
  - **For AutoPart E-Com:** Indentifying year, make and model types from catalogs.

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The Solution: Schema Learning Framework

- Schema generation without indexing

- Offline training
  - With raw documents
  - Support for Type Hierarchy configuration

- Generated Schema can be used for actual indexing

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Schema Learning Framework

- Supports two types of inference :

❖ Primitives/Regex based inference

❖ ML Model based inference

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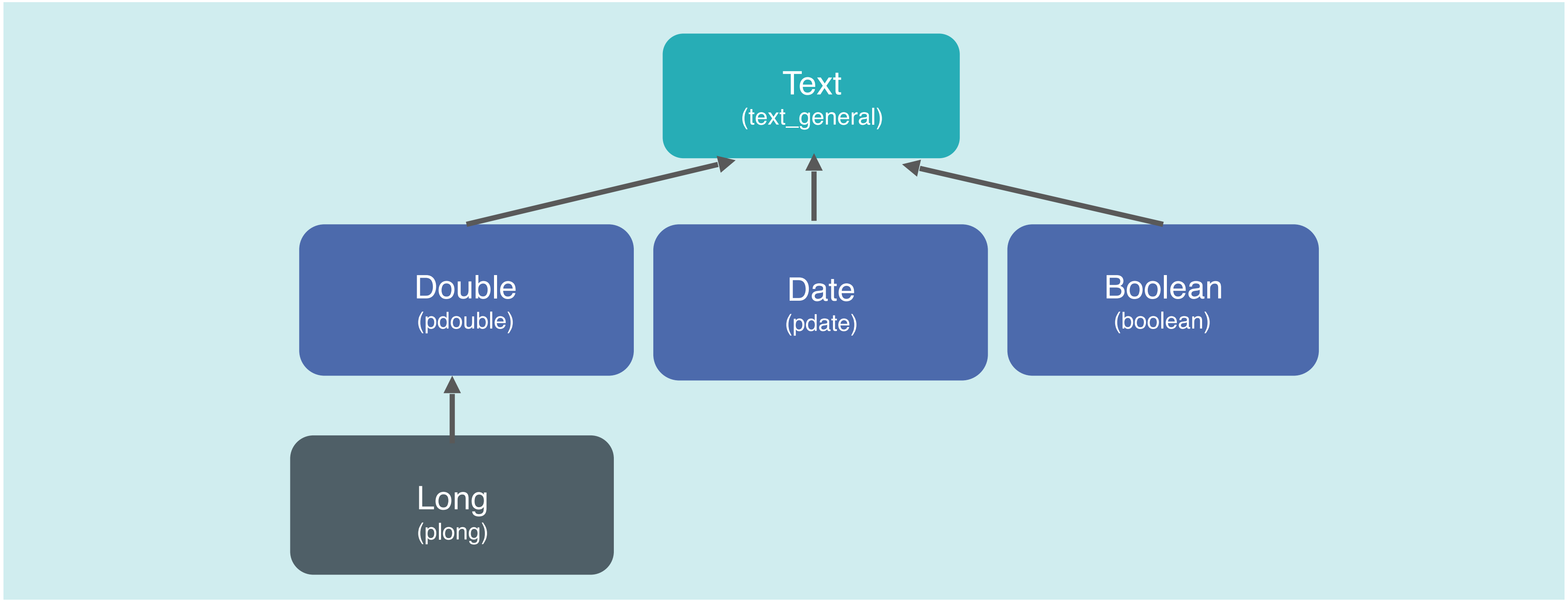
Schema Learning Framework:

Primitives/Regex based inference

- A Type Hierarchy needs to be defined for the Primitive/Regex Types
    - ❖ what other types a field type has to support
- This Type Hierarchy is used while Assigning optimal types
    - ❖ *Example:* A field having both *Long* and *Double* will be assigned *Double* Type
- Regex can be defined along side Primitive

Schema Learning Framework:

Type Hierarchy: Primitives based inference



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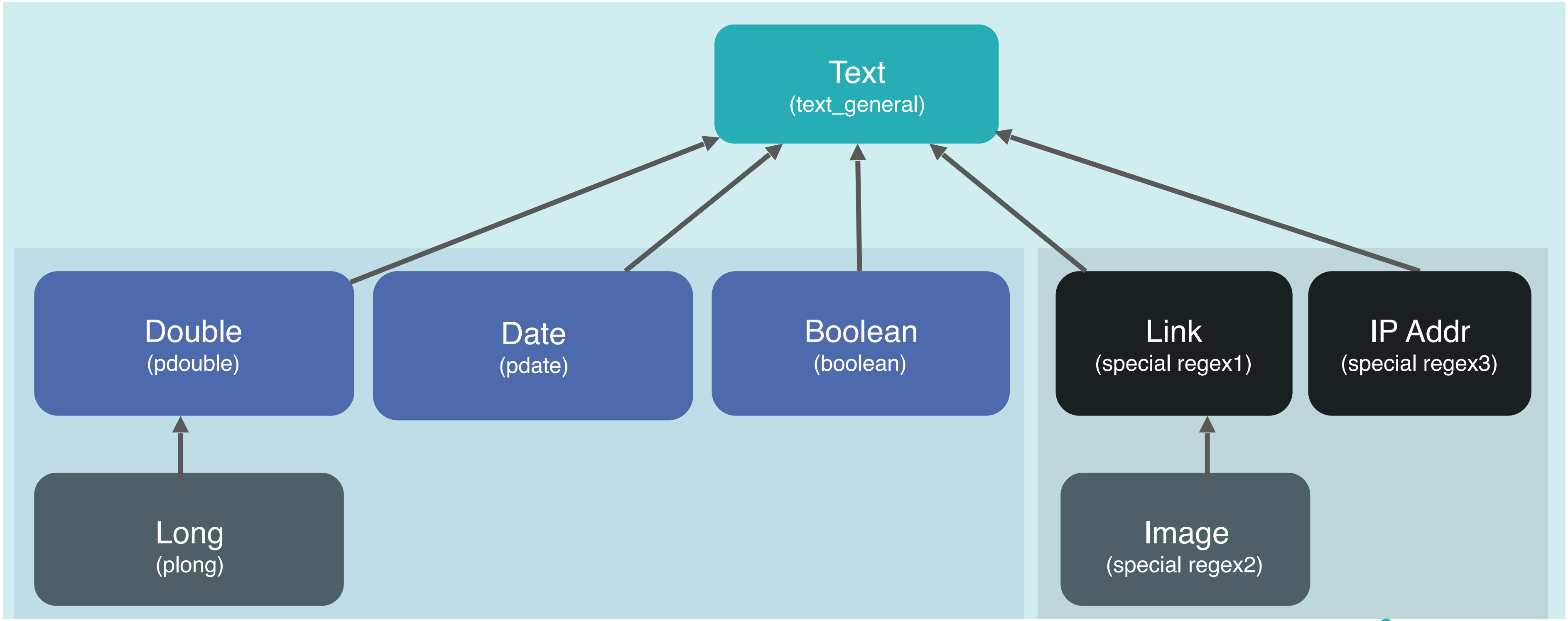
Schema Learning Framework:

Type Hierarchy: Primitives+Regex based inference



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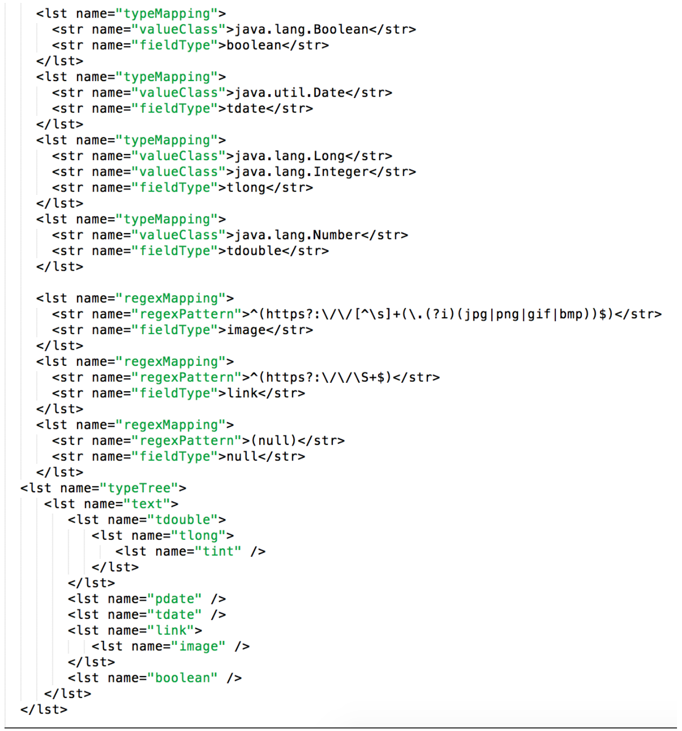
Schema Learning Framework:

Primitives+Regex based inference : Configuration



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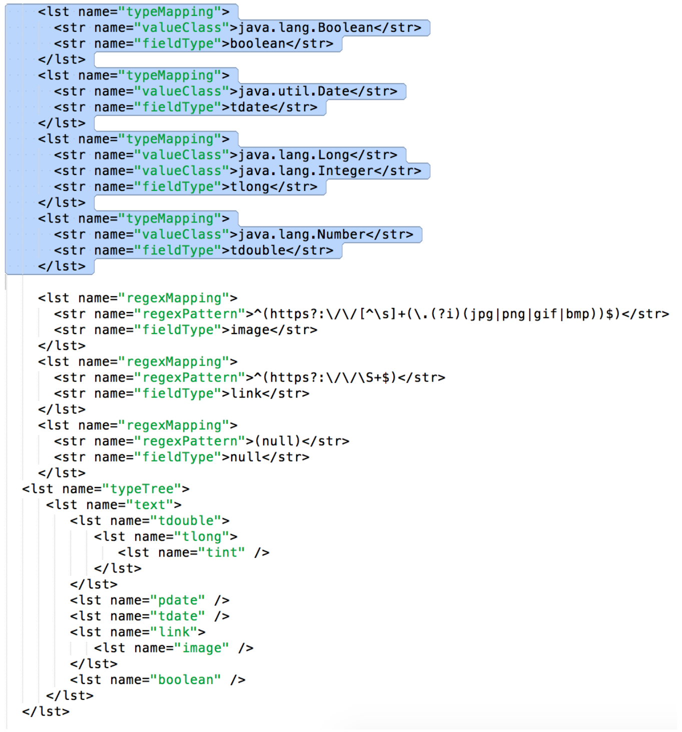
Schema Learning Framework:

Primitives+Regex based inference : Configuring Primitive Types Mapping



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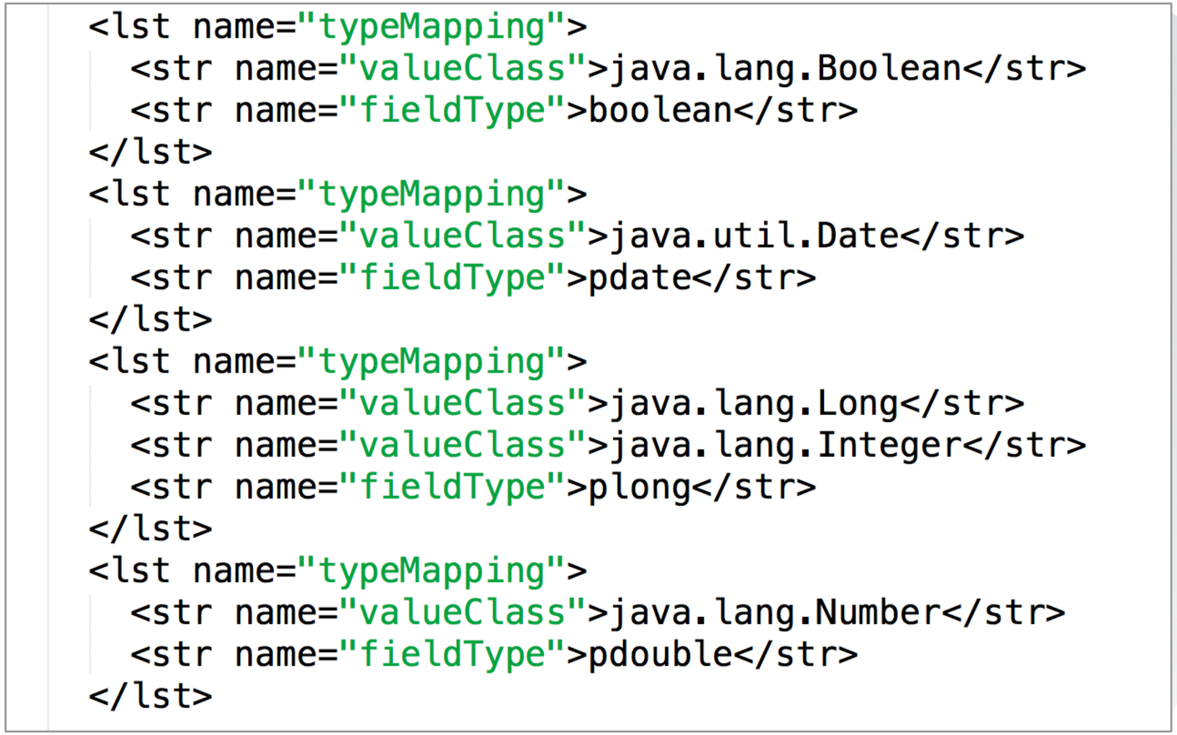
Schema Learning Framework:

Primitives+Regex based inference : Configuring Primitive Types Mapping



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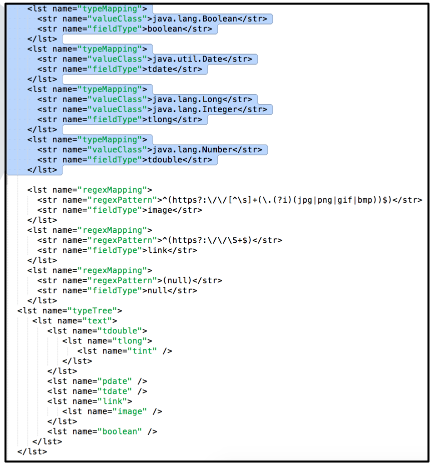

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```

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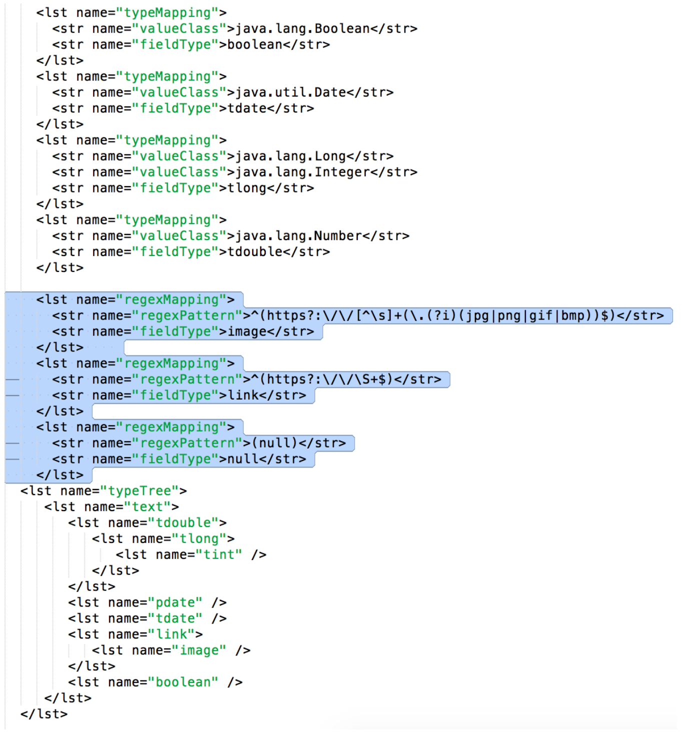
Schema Learning Framework:

Primitives+Regex based inference : Configuring Regex Types Mappings



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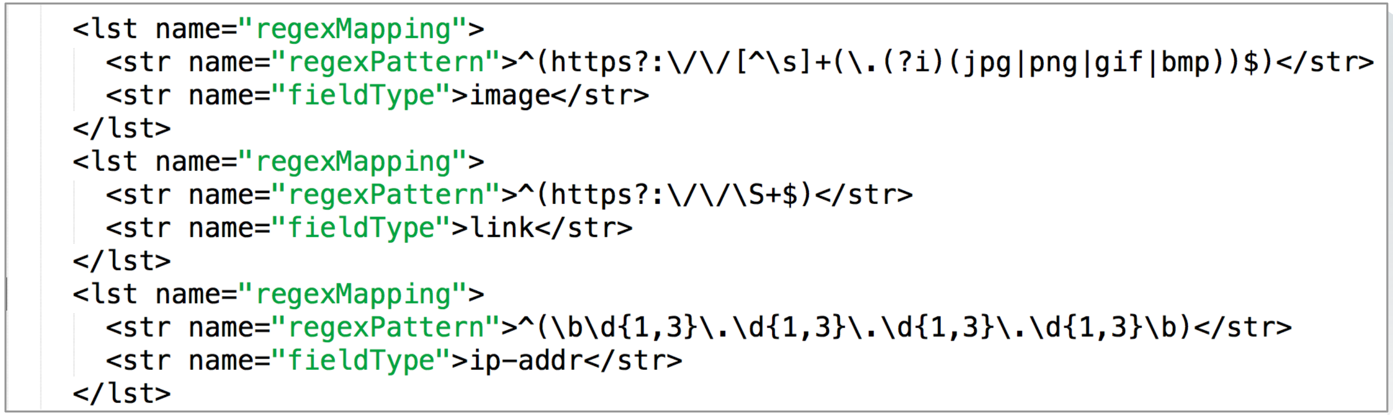
Schema Learning Framework:

Primitives+Regex based inference : Configuring Regex Types Mappings



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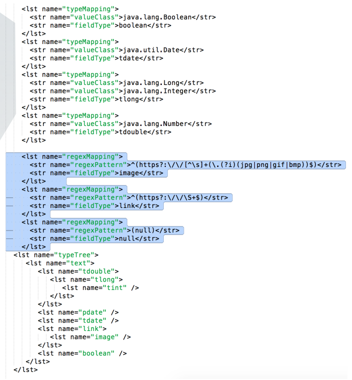

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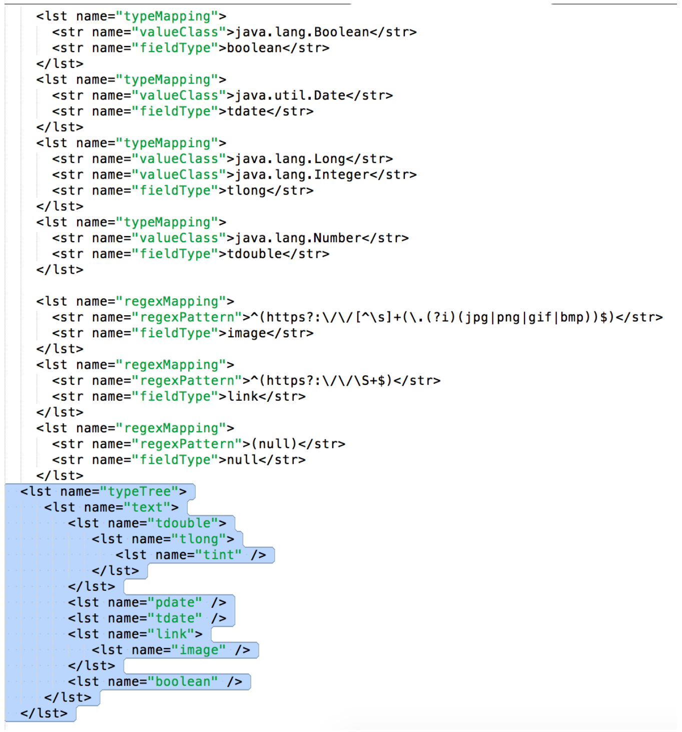
Schema Learning Framework:

Primitives+Regex based inference : Configuring Field-Type Hierarchies



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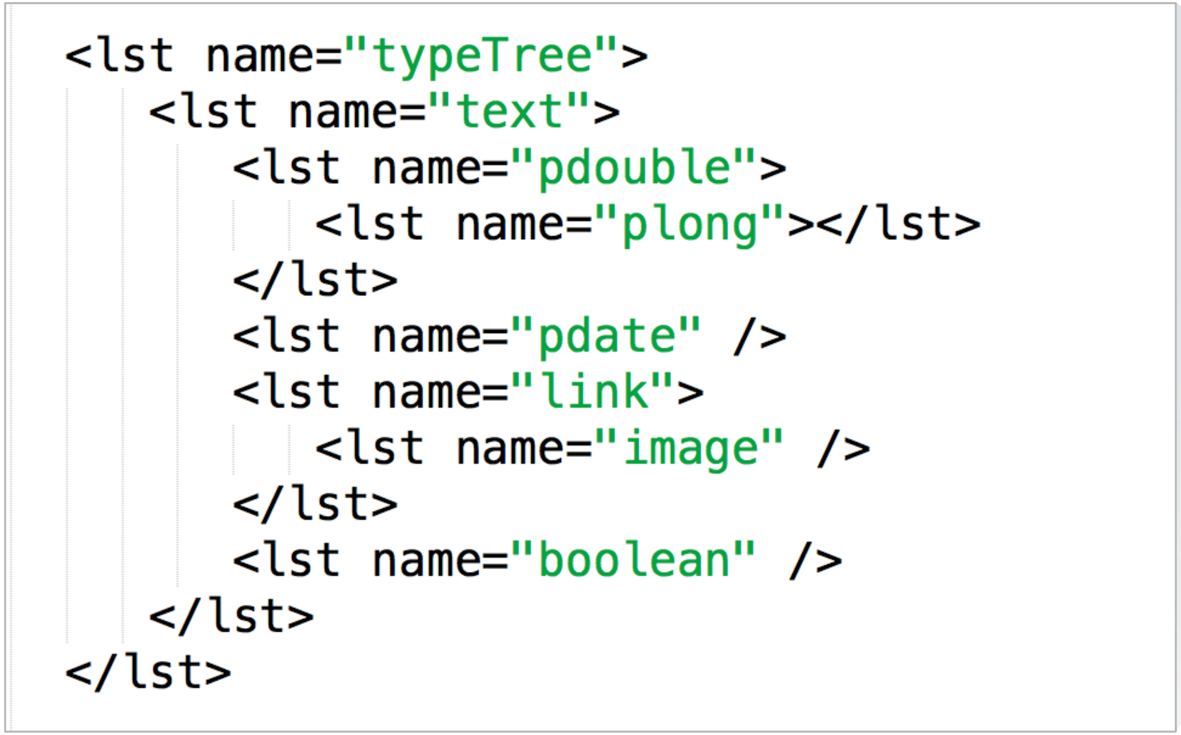
Schema Learning Framework:

Primitives+Regex based inference : Configuring Field-Type Hierarchies



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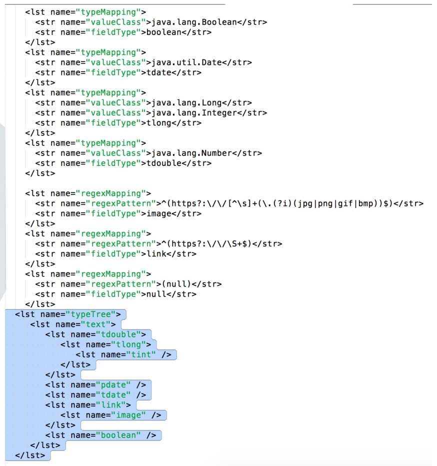

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```

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Schema Learning Framework:

Primitives based Inference

- Demo

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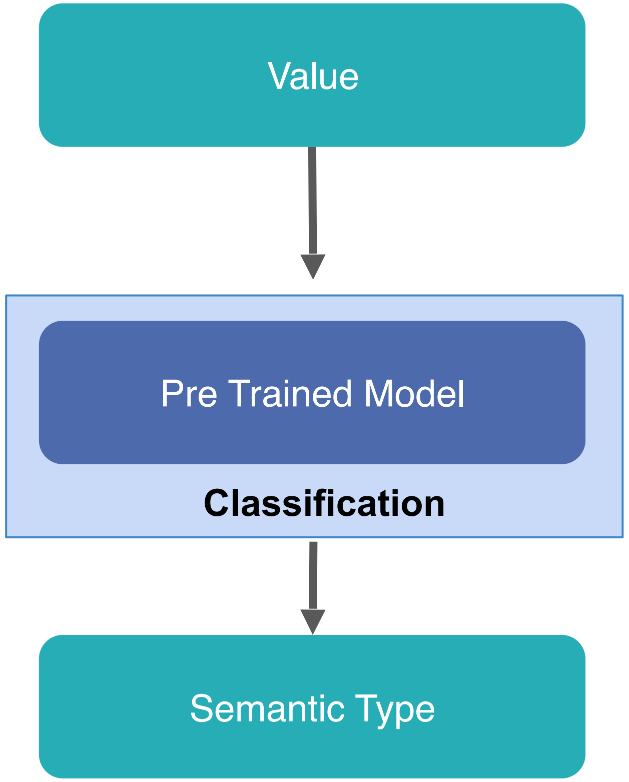
Schema Learning Framework:

Model based inference

- Pluggable Pre-Trained models
- *Semantic Type Inference*

❖ Example:

➢ Red	→ Color
➢ Men's Shirt	→ Category
➢ Blue Formal Shirt	→ Title
➢ Gini & Jony	→ Brand



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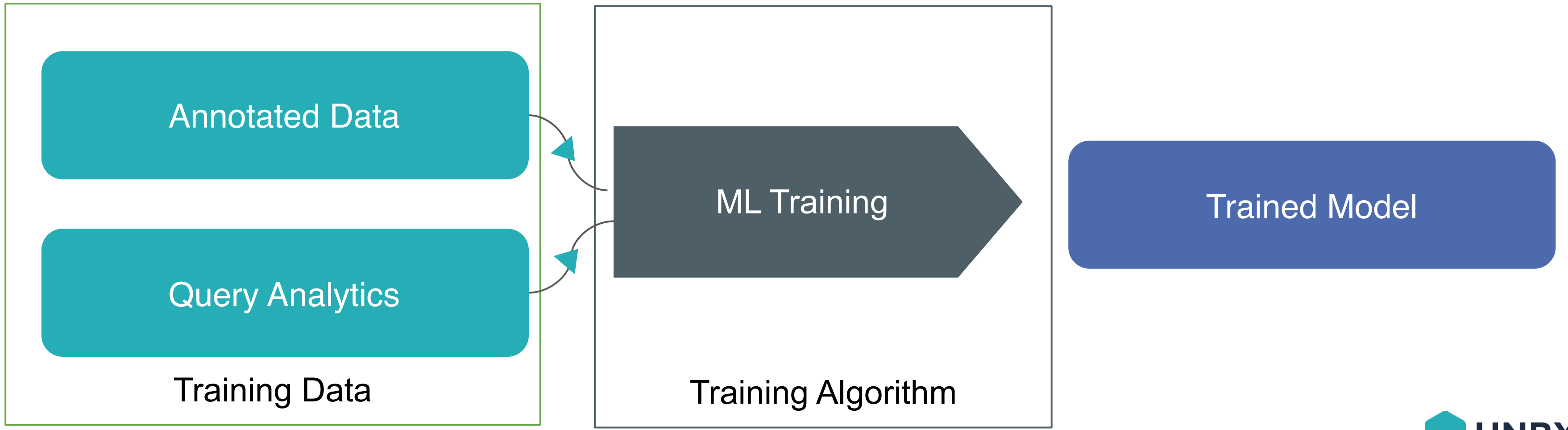
Schema Learning Framework:
Model based inference: Training

- Models can be trained with:
  - Pre-Annotated Judgements : {“grape green”->”color”, “red monsoon shirt ” -> “title” }
  - Query Analysis Data



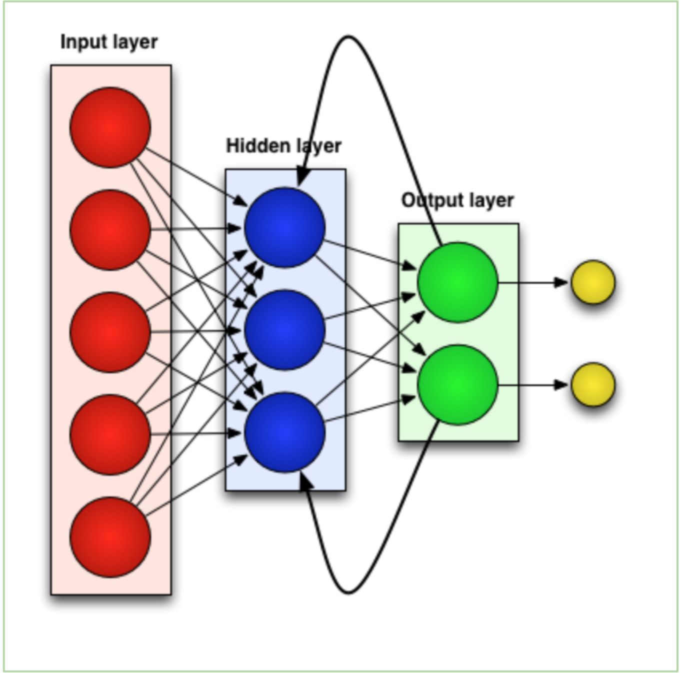
Schema Learning Framework:

Model based inference: Training

- *Recurrent Neural Networks (RNN)*

❖ Feedback loops

❖ Contextual Learning



Schema Learning Framework:

Model based inference

- Demo

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Conclusion

- A framework within Solr
- Supports hierarchies of syntactic & semantic types
- Pluggable Domain Specific Inference
- Automated Creation of Accurate Schema

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Roadmap

- SOLR-11741, SOLR-6939
  - Chris Hostetter(Hoss Man), Committer Lucene Solr

- Phase 1: Framework, primitives inference & regex inference

- Phase 2: Model inference (pluggability)

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The Team

Kishore Angani
Senior Architect, Unbxd

Ishan Chattopadhyaya
Search Architect, Unbxd
Lucene/Solr Committer

Abhishek Kumar Singh
Search Engineer,
Unbxd

Jestin James
Sr. Interaction Designer,
Unbxd

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