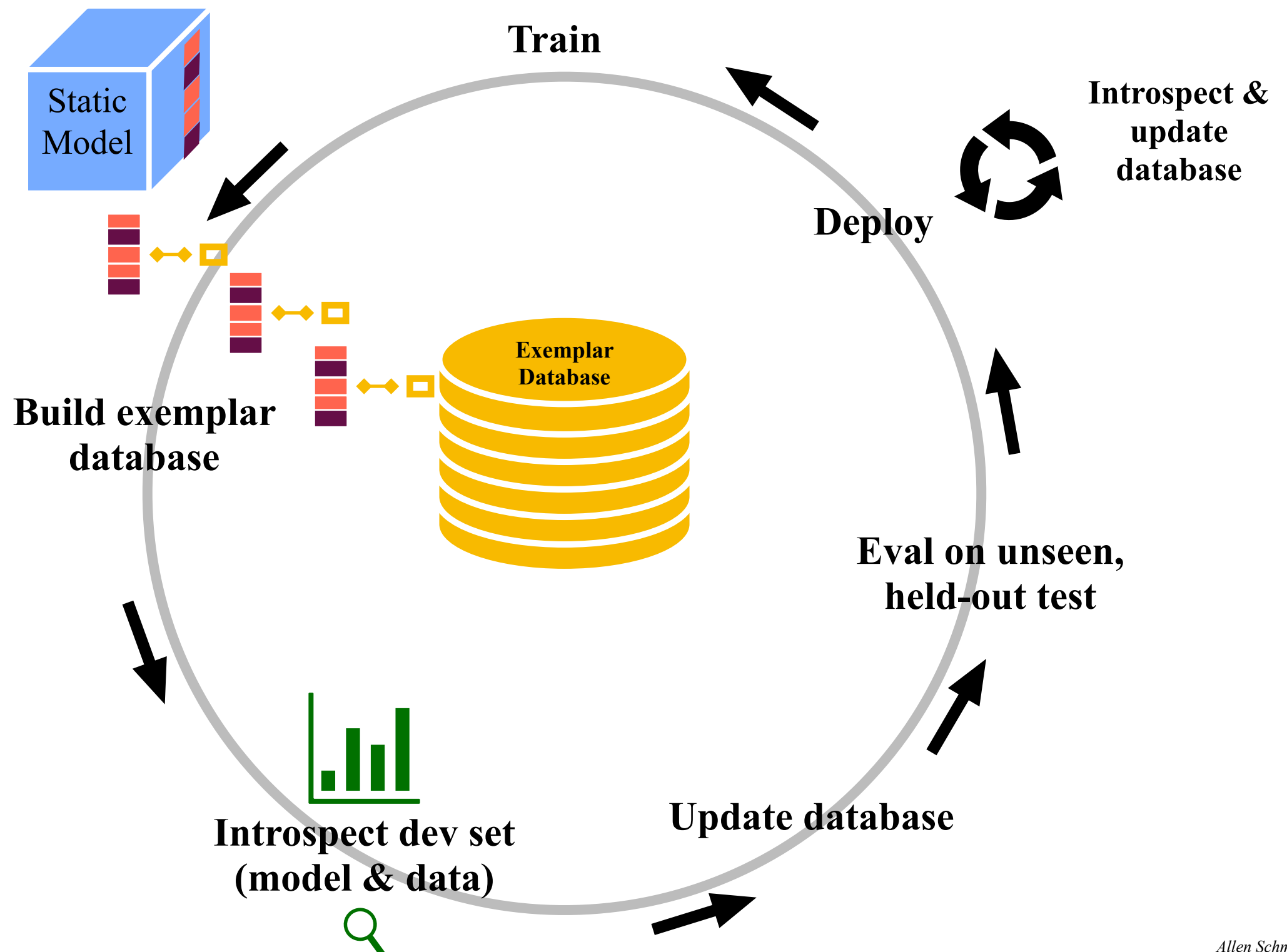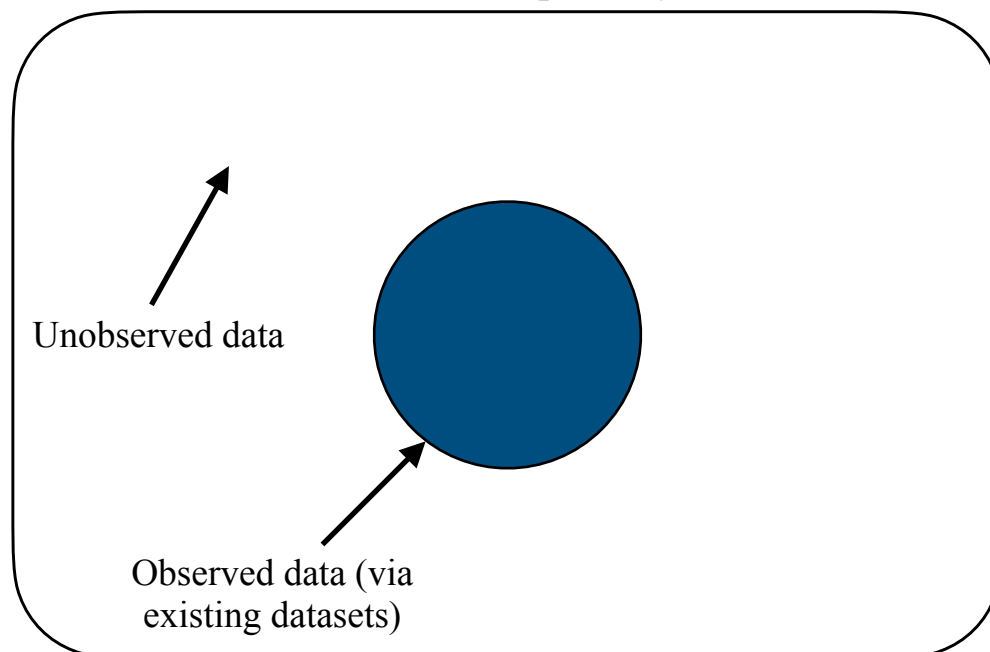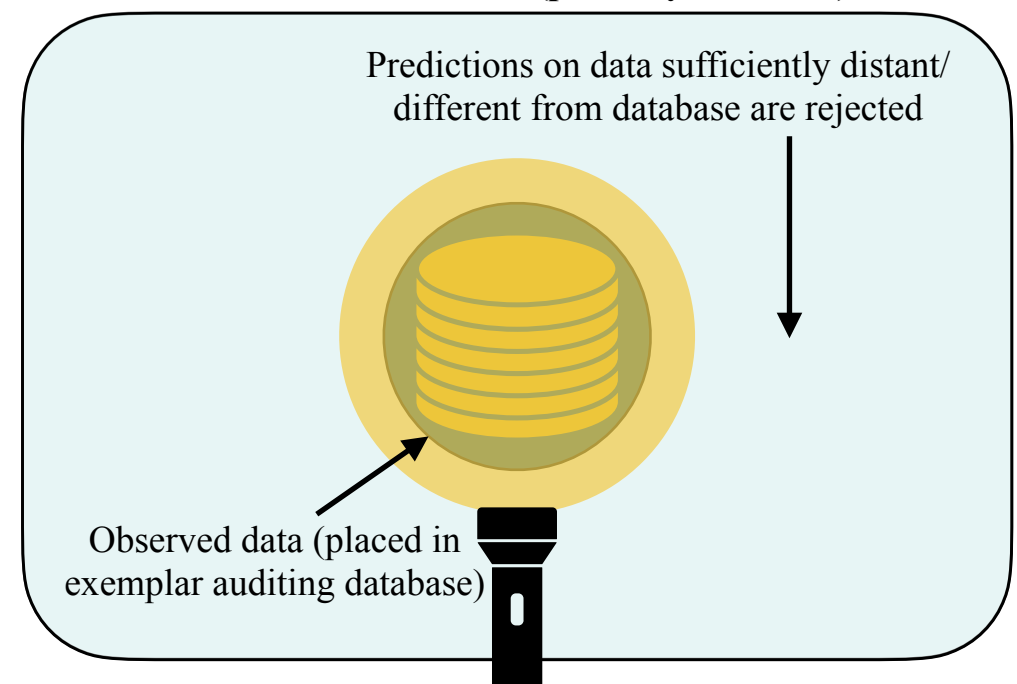# Exemplar Auditing Lifecycle

Out-of-Domain Settings

- Pre-train with as much data as possible

- Add as much data as possible to the database

  - Corral the in-domain space, around the ball of the observed data

  - Never predict over out-of-domain data in high-risk settings. Instead: Rearrange the deployment to handle non-admitted predictions.

Data distribution for task (partially observed)

Unobserved data

Observed data (via existing datasets)

Data distribution for task (partially observed)

Predictions on data sufficiently distant/ different from database are rejected

Observed data (placed in exemplar auditing database)

Implementations

- Binary classification: $f : X \to \{0,1\}$

  - "Detecting Local Insights from Global Labels: Supervised & Zero-Shot Sequence Labeling via a Convolutional Decomposition"

- Multi-label classification: $f : X \to 2^{|Y|}$

  - "Exemplar Auditing for Multi-Label Biomedical Text Classification"

- Retrieval-classification: $f : X \times \mathscr{D} \to \left\langle \{0,1,2\}, \, 2^{|D|} \right\rangle$

  - "Coarse-to-Fine Memory Matching for Joint Retrieval and Classification"
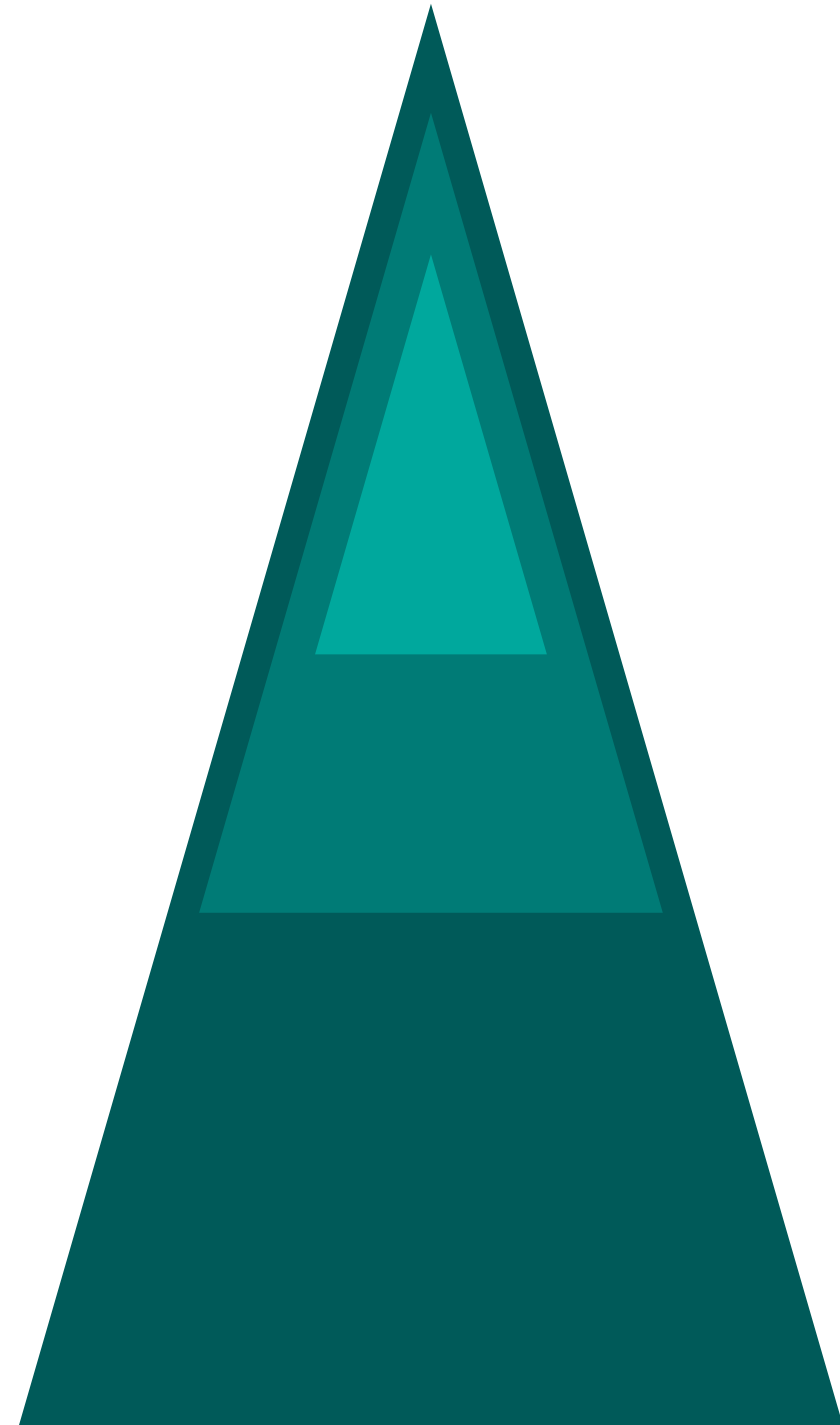
An End-to-End Retrieval-Classification Model via a Coarse-to-Fine Search over Dense Representations

min L^2 distance

CNN

Shared Transformer LM

Seq Q

Initial, coarse bi-encoder search

CNN

Shared Transformer LM

$\forall$ S : **Seq S**

min L^2 distance

CNN

CNN

Shared Transformer LM

Shared Transformer LM

Seq Q

$\forall$ **S from previous level** } **concat(Seq Q, Seq S)**

Subsequent search levels employ cross-encoder search, over the winnowed sequences from earlier levels

Allen Schmaltz, 2019-2021
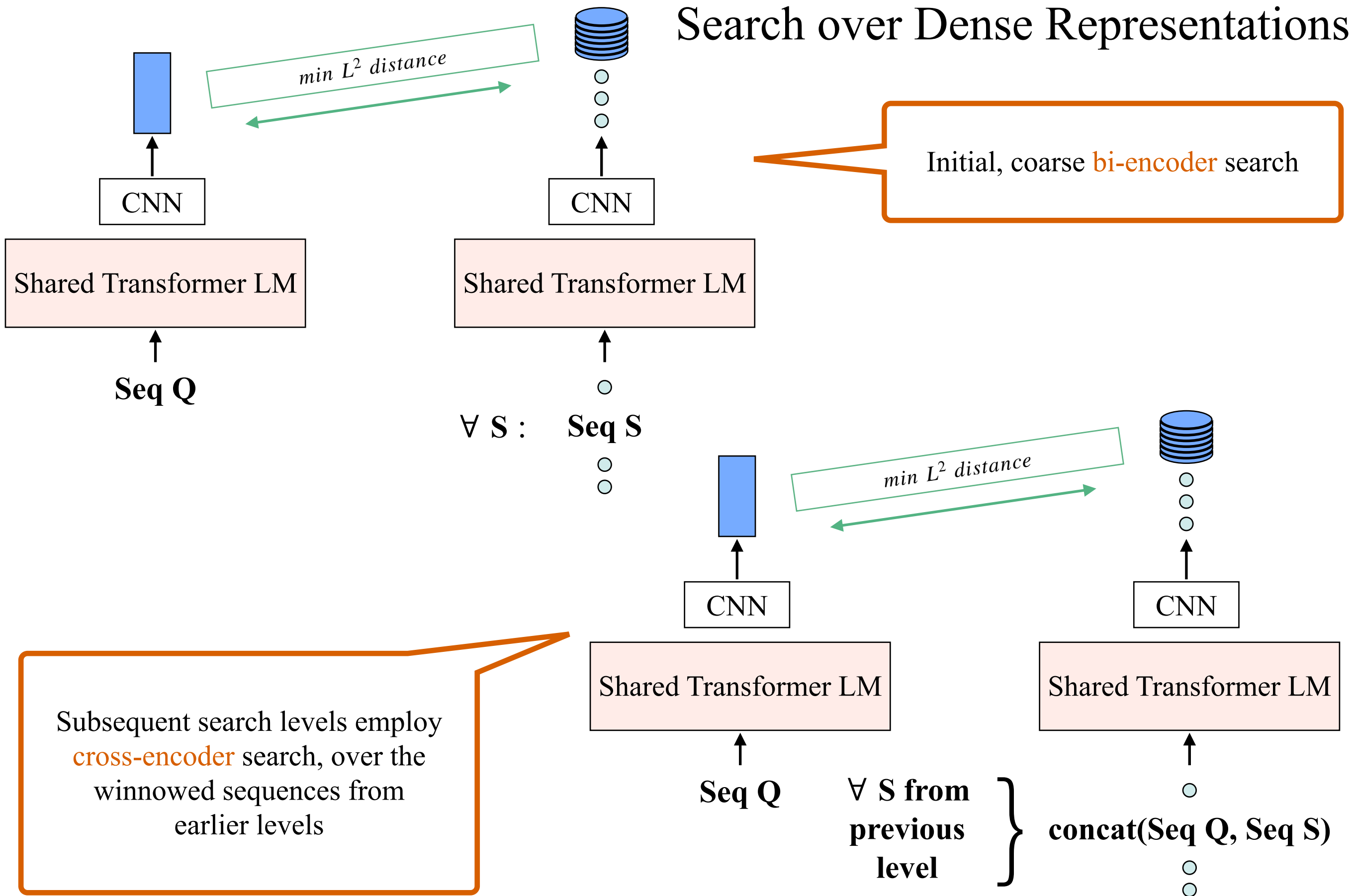
Multi-Sequence Representation Composition for Exemplar Auditing

Dense representation of query sequence:

$$\boldsymbol{g}^q \in \mathbb{R}^{1000} = \begin{bmatrix} g_1^q \\ g_2^q \\ \vdots \\ g_{1000}^q \end{bmatrix}$$

Dense representation of support sequence:

$$\boldsymbol{g}^s \in \mathbb{R}^{1000} = \begin{bmatrix} g_1^s \\ g_2^s \\ \vdots \\ g_{1000}^s \end{bmatrix}$$

$$\boldsymbol{\delta}_{L_2} = \left| \boldsymbol{g}^q - \boldsymbol{g}^s \right| \in \mathbb{R}^M$$

CNN

Shared Transformer LM

Seq Q

CNN

Shared Transformer LM

concat(Seq Q, Seq S)

Search levels

$$\boldsymbol{\delta}_{L_3} = \left| \boldsymbol{g}^q - \boldsymbol{g}^s \right| \in \mathbb{R}^M$$

CNN

Shared Transformer LM

Seq Q

CNN

Shared Transformer LM

concat(Label, Seq Q, Seq S*)

Final composed representation:
concat($\boldsymbol{\delta}_{L_2}$, $\boldsymbol{\delta}_{L_3}$)

Exemplar Database

Allen Schmaltz, 2019-2021

Token-Level Representations for Exemplar Auditing
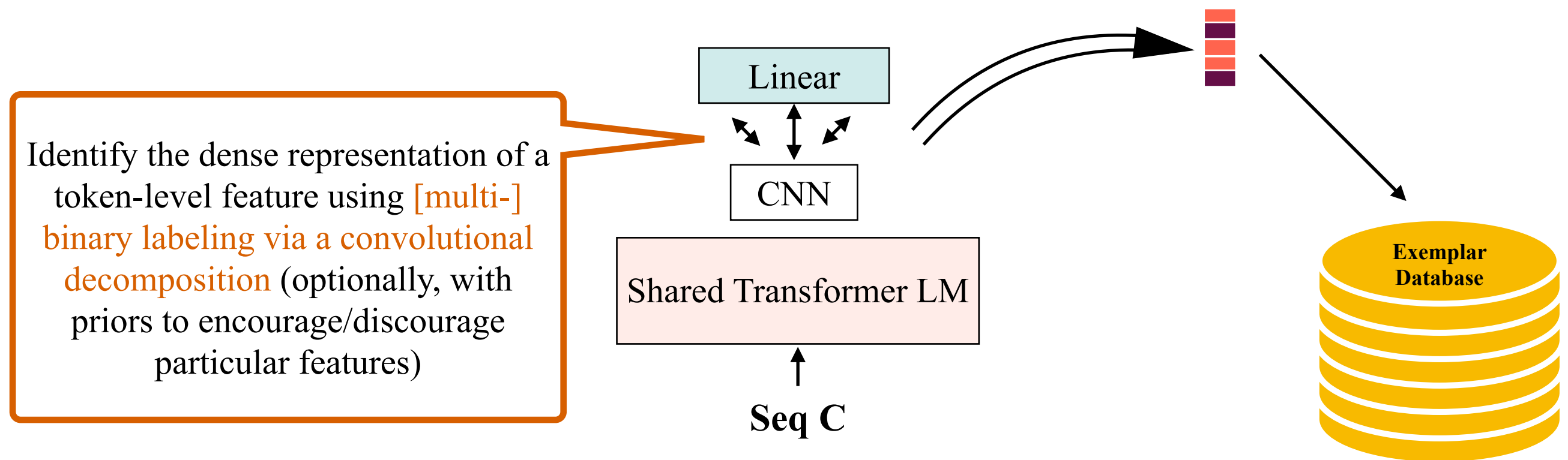
Prospective Outlook: Interlocking distance constraints across input modalities and tasks via a single, shared model and a dense database...

Productive multi-task outlook, since we get practical models & data analyses along the way

DB

Neural Model

Myoglobin (image from Wikipedia)

Allen Schmaltz, 2019-2021