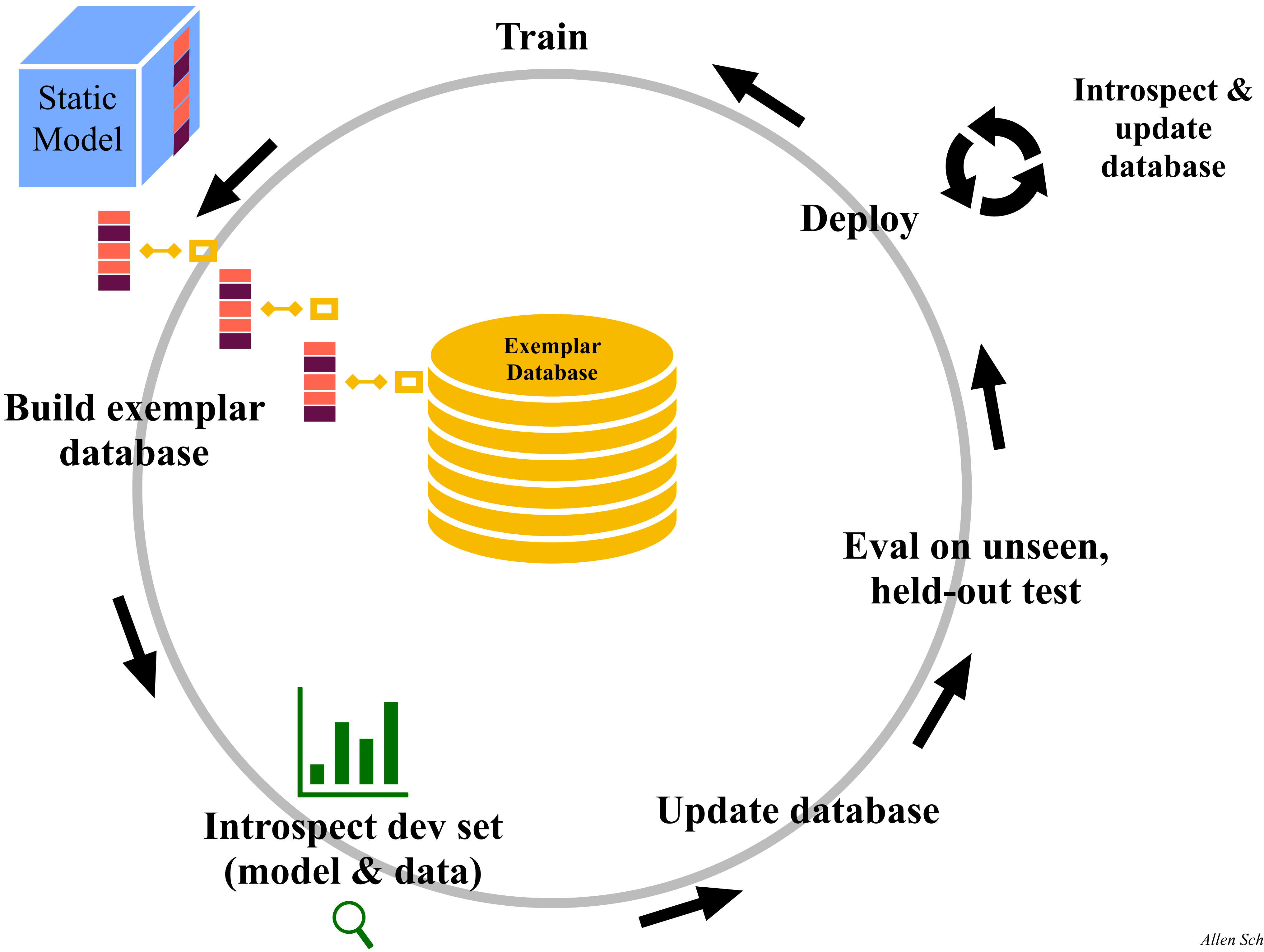
Exemplar Auditing Lifecycle



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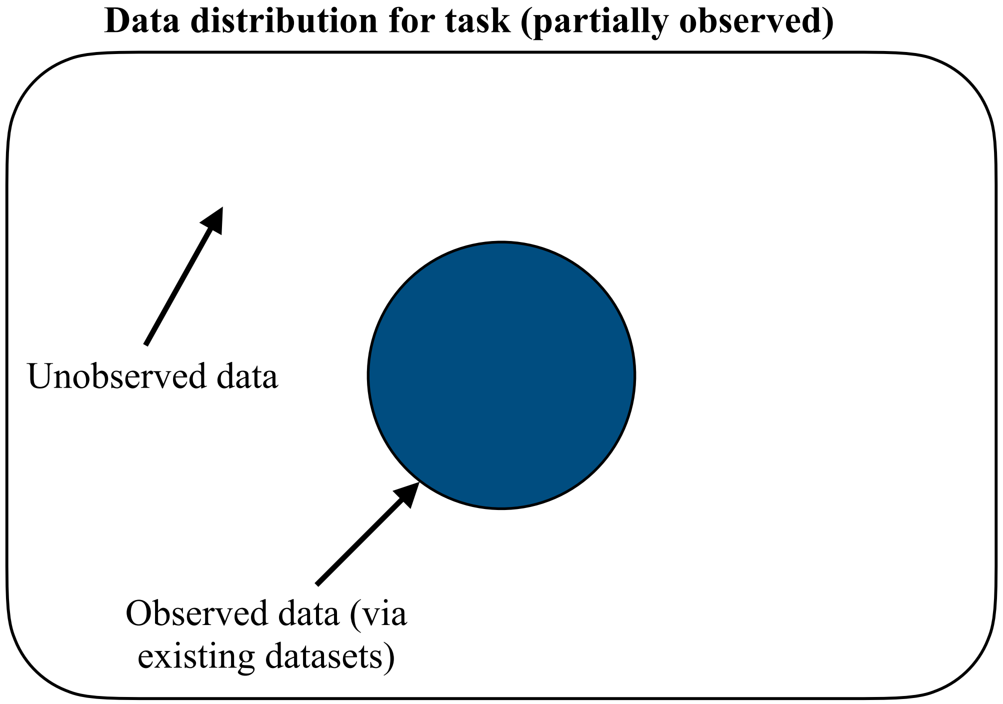
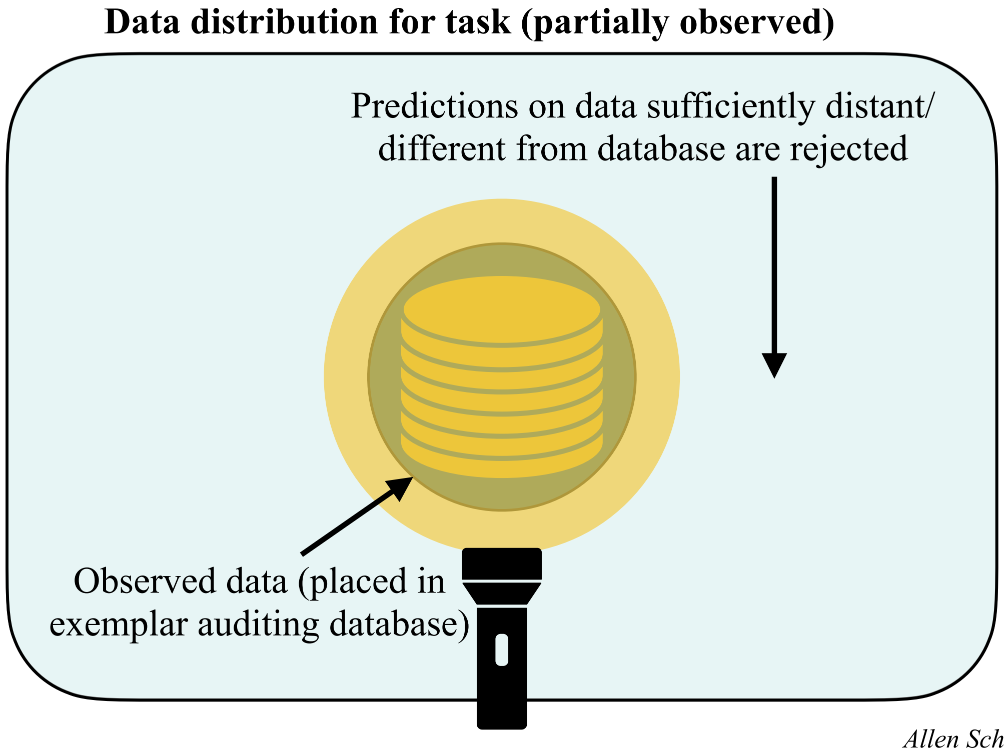
Out-of-Domain Settings

- 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)

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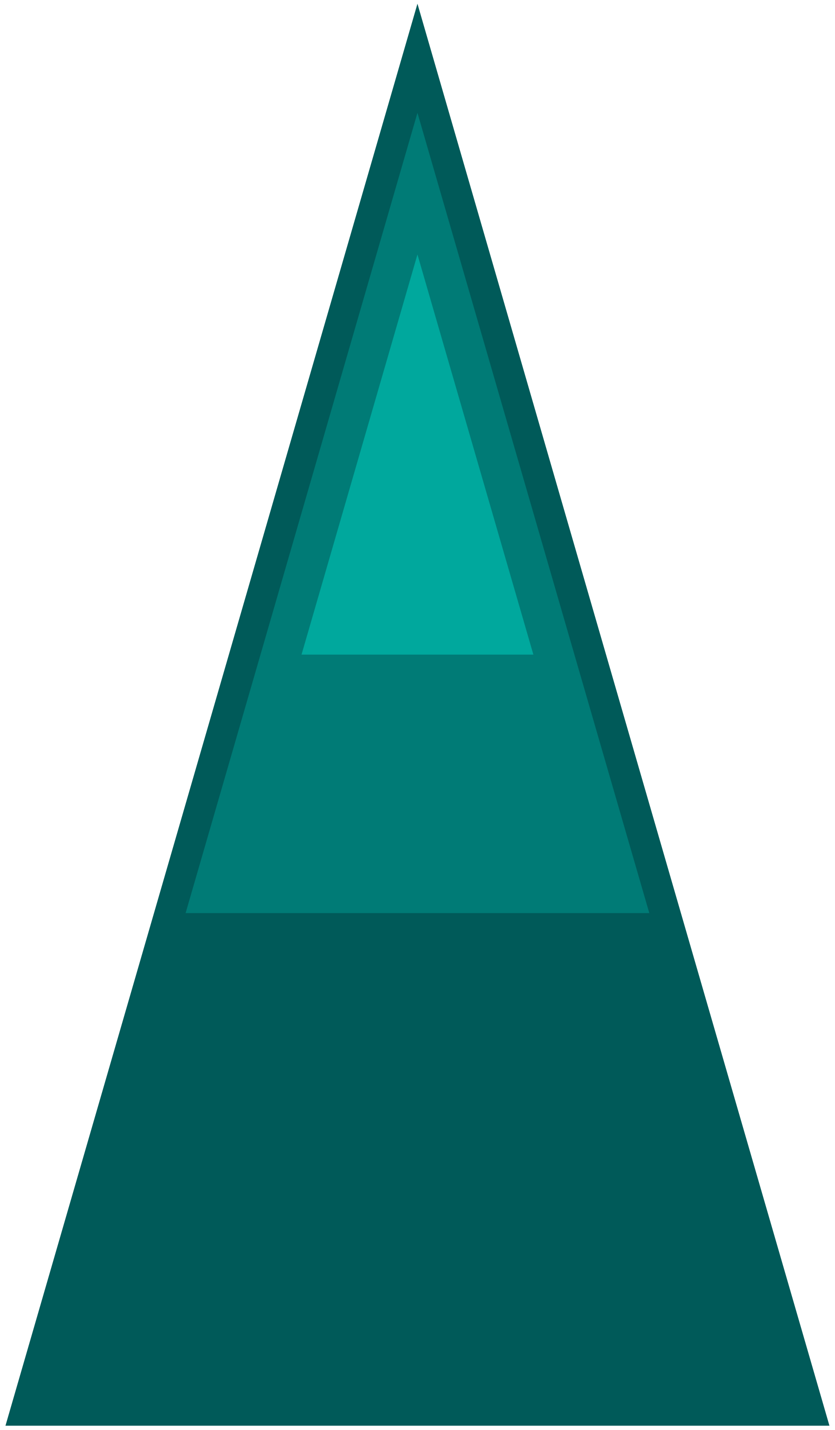
Implementations

- 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”



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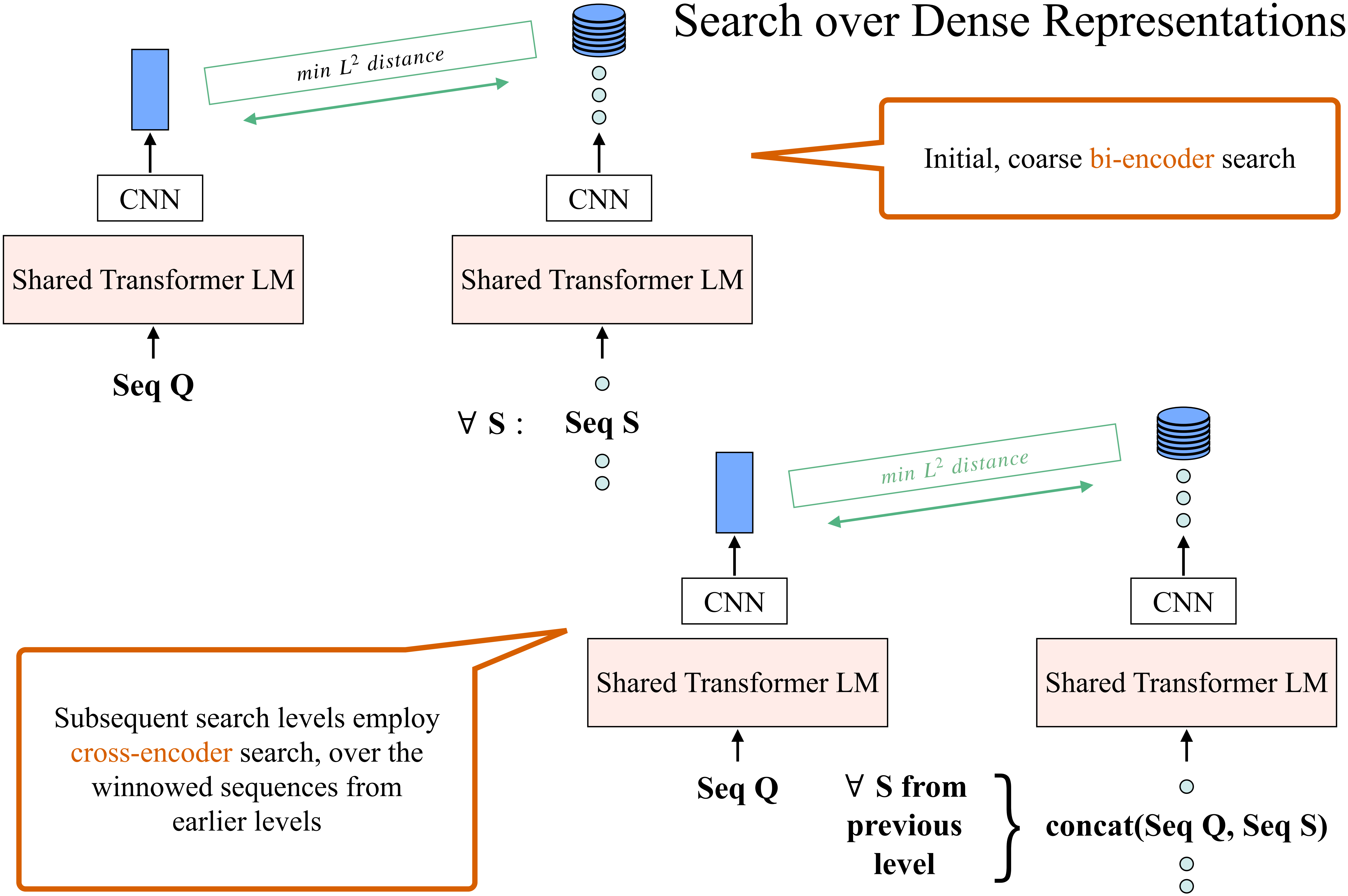
An End-to-End Retrieval-Classification Model via a Coarse-to-Fine Search over Dense Representations



Initial, coarse bi-encoder search

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

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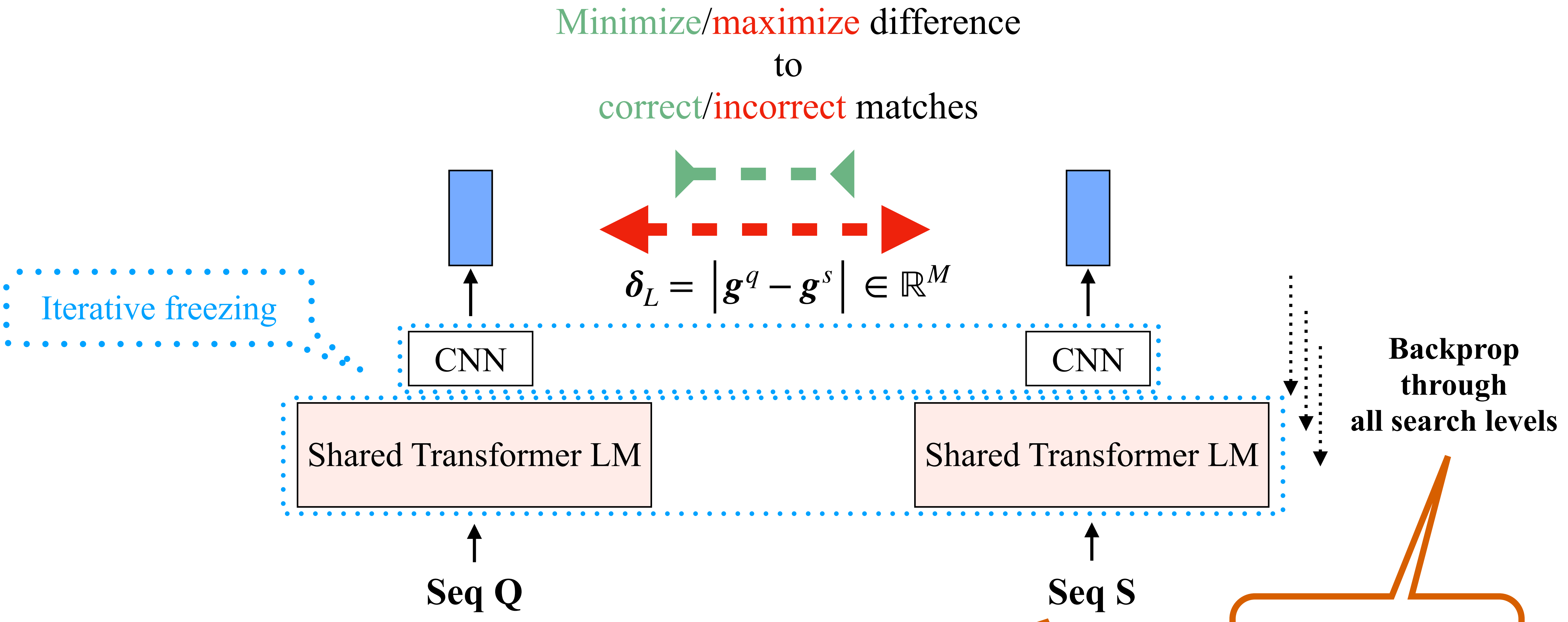
Joint Retrieval and Classification Training



The training set is dynamically created via coarse-to-fine search to find hard negatives, as well as prediction sequences that emulate inference

Yields a single model for both retrieval and classification

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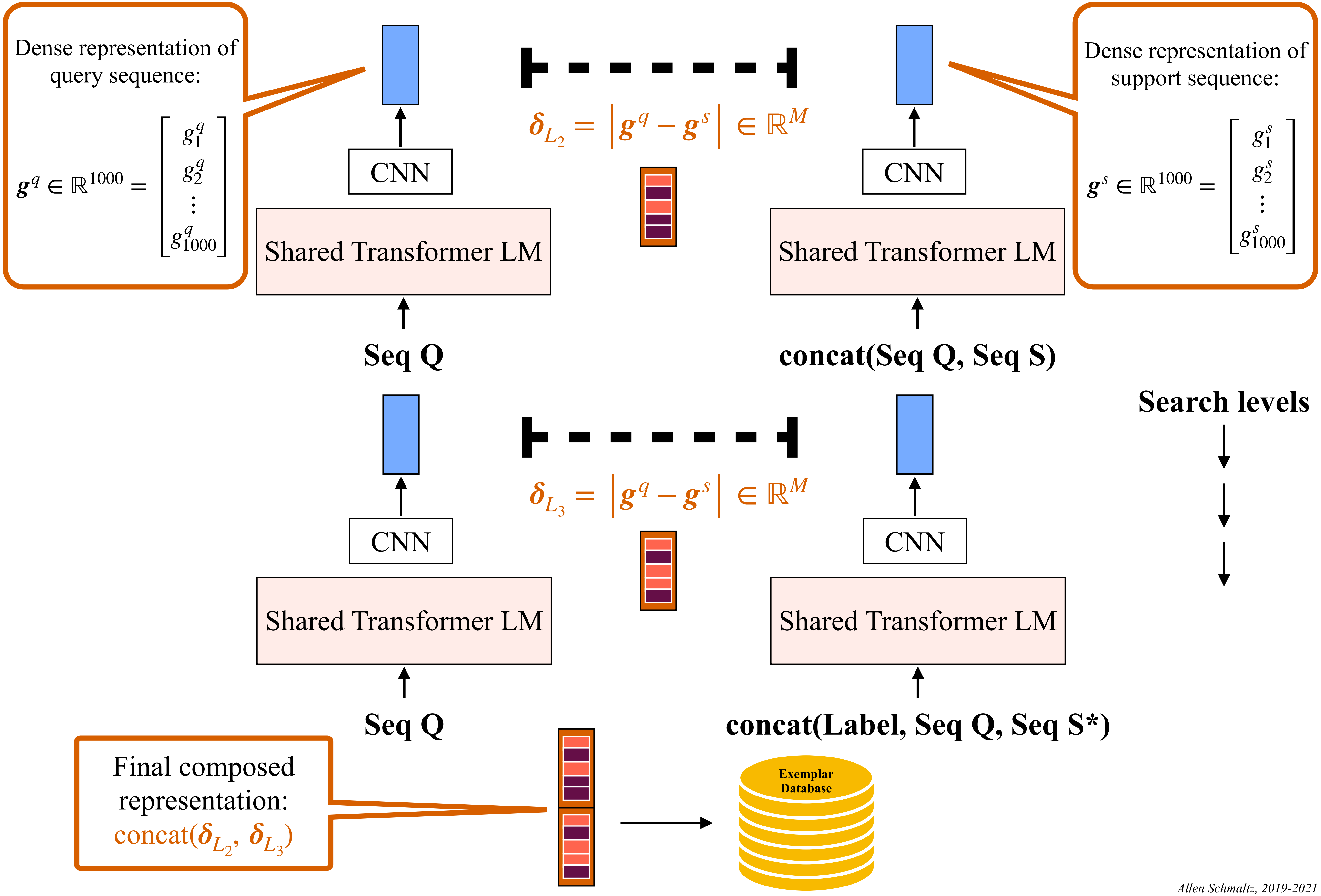
Multi-Sequence Representation Composition for Exemplar Auditing



Dense representation of query sequence:

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

CNN

Shared Transformer LM

Seq Q

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

Dense representation of support sequence:

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

CNN

Shared Transformer LM

concat(Seq Q, Seq S)

CNN

Shared Transformer LM

Seq Q

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

CNN

Shared Transformer LM

concat(Label, Seq Q, Seq S*)

Search levels

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

Exemplar Database

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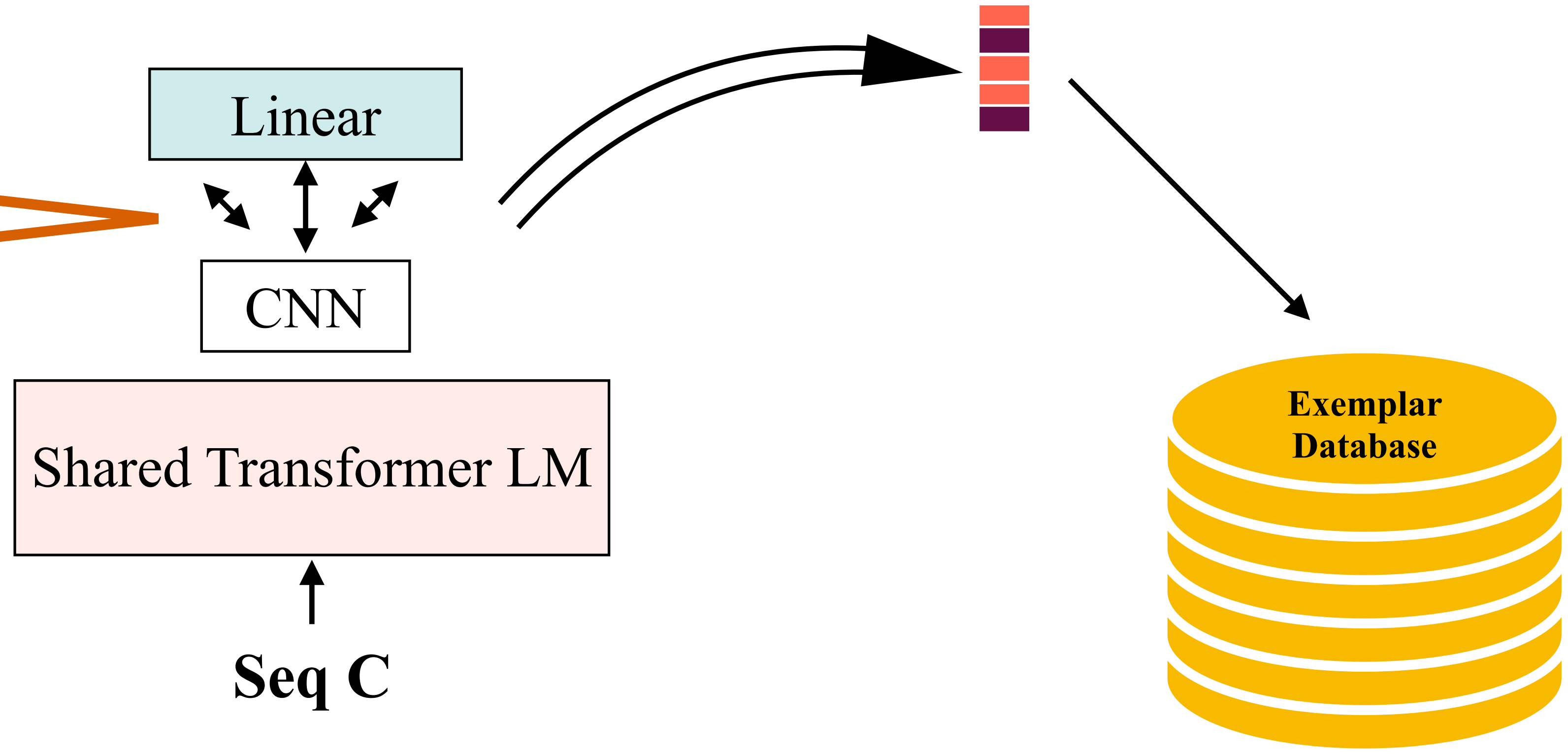
Token-Level Representations for Exemplar Auditing

Identify the dense representation of a token-level feature using [multi-] binary labeling via a convolutional decomposition (optionally, with priors to encourage/discourage particular features)



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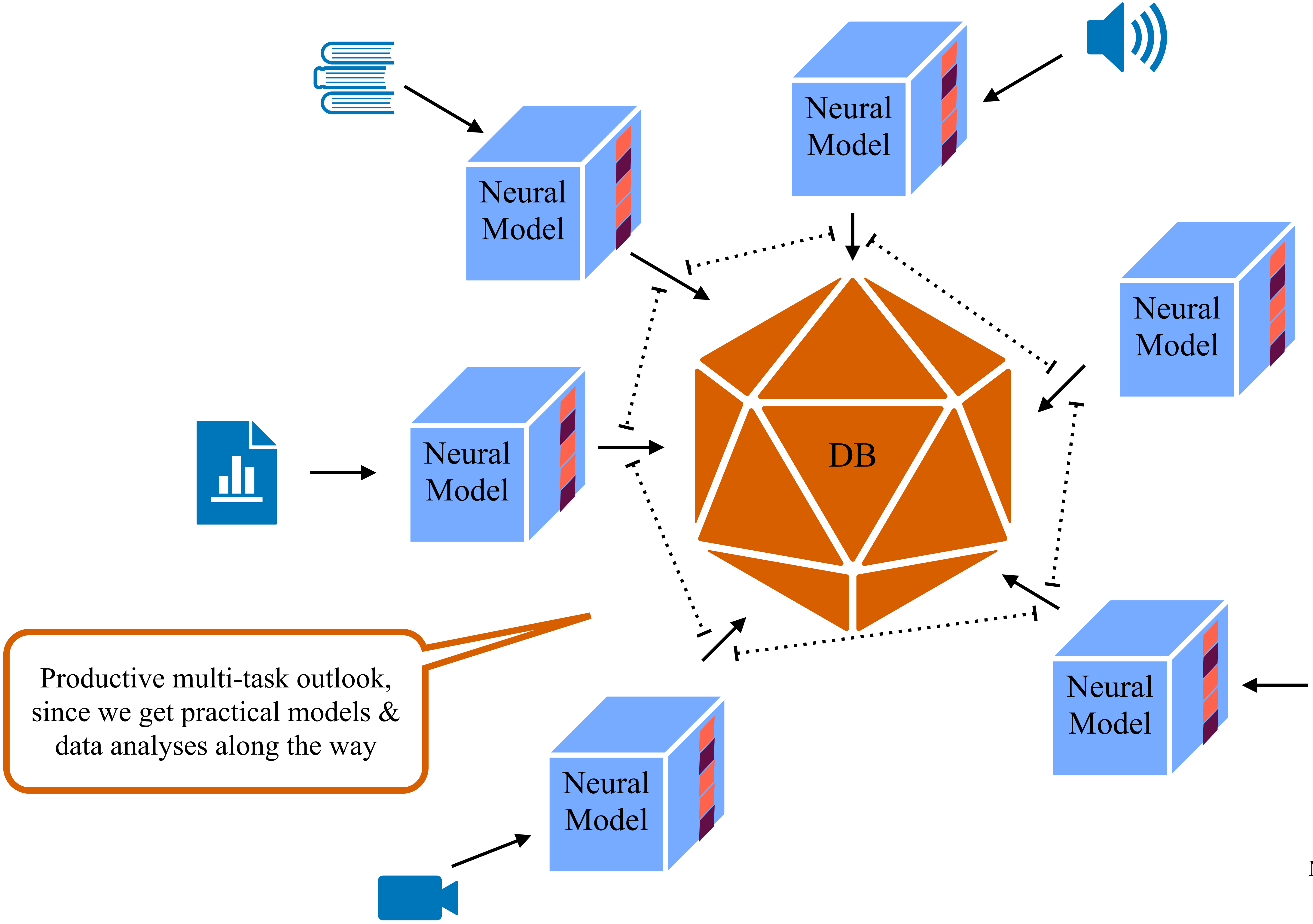
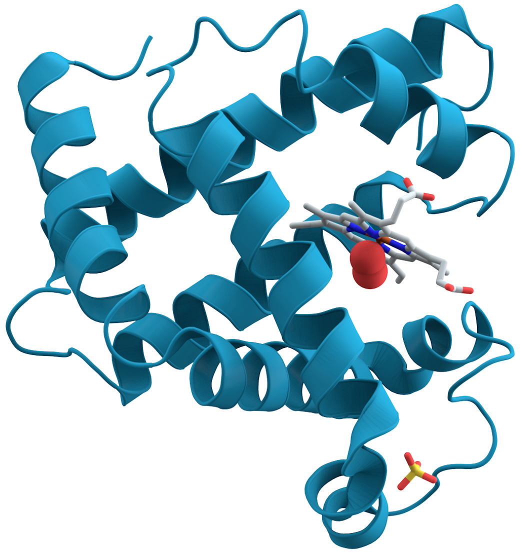
Prospective Outlook: Interlocking distance constraints across input modalities and tasks via a single, shared model and a dense database…



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



Myoglobin (image from Wikipedia)

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