Algorithmic Resignation

Umang Bhatt
Assistant Professor/Faculty Fellow, New York University
Research Associate, The Alan Turing Institute
Associate Fellow, Leverhulme Center for the Future of Intelligence

@umangsbhatt
umangbhatt@nyu.edu

The Alan Turing Institute

CFI

When Should Algorithms Resign?

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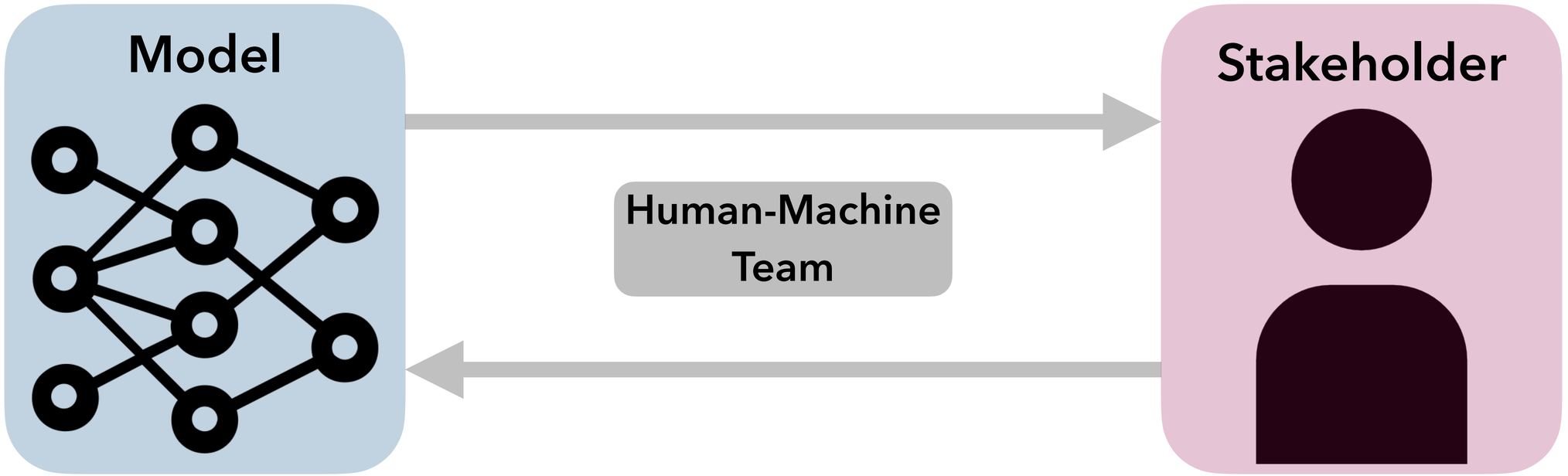
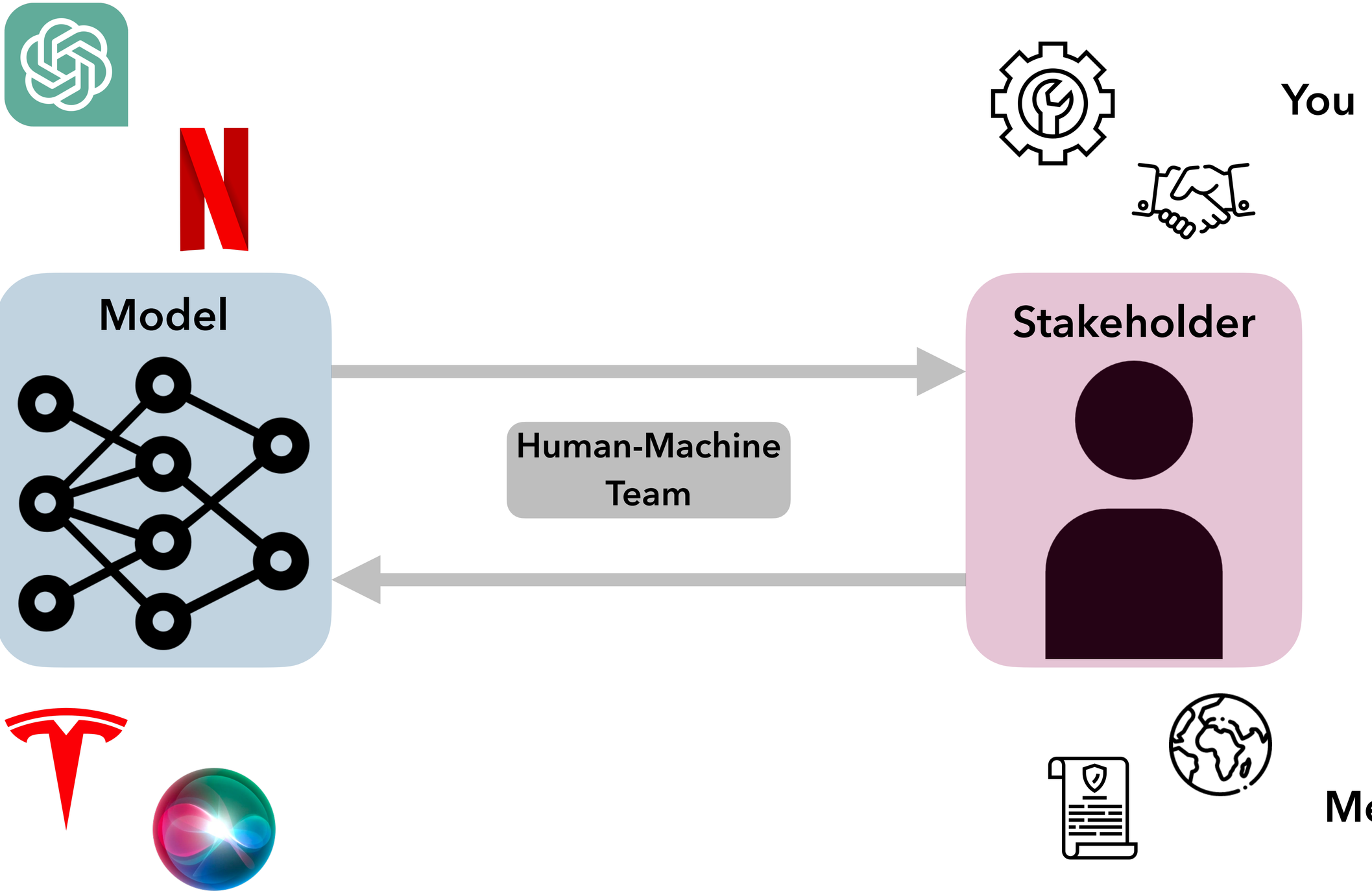
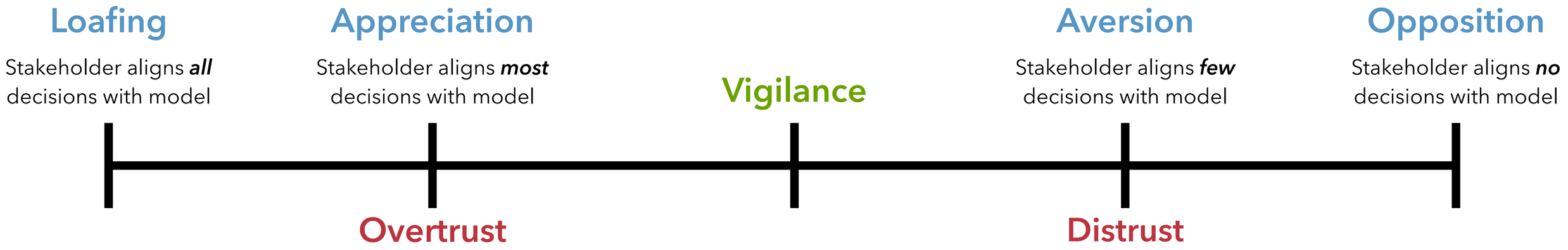

Model
Human-Machine
Team
Stakeholder


You
Model
Stakeholder
Human-Machine
Team
Me



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Zerilli, **B**, Weller. *How transparency modulates trust in artificial intelligence.* Patterns. 2022.

Loafing | Appreciation | Vigilance | Aversion | Opposition

POLITICS

Judge sanctions lawyers for brief written by A.I. with fake citations

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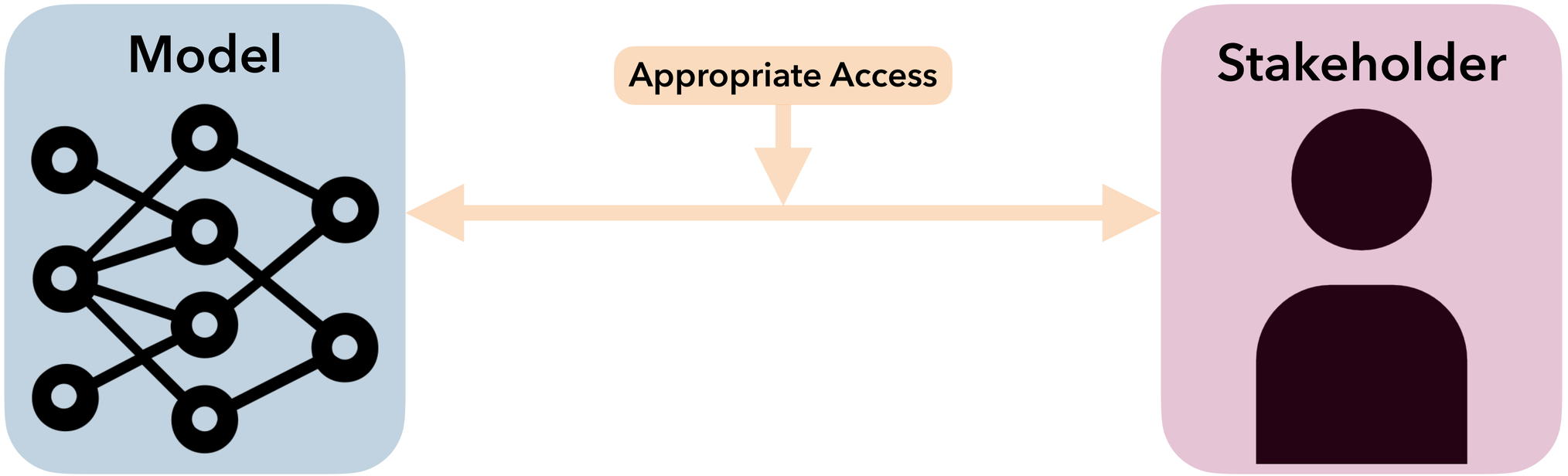
95

Zerilli, **B**, Weller. *How transparency modulates trust in artificial intelligence.* Patterns. 2022.



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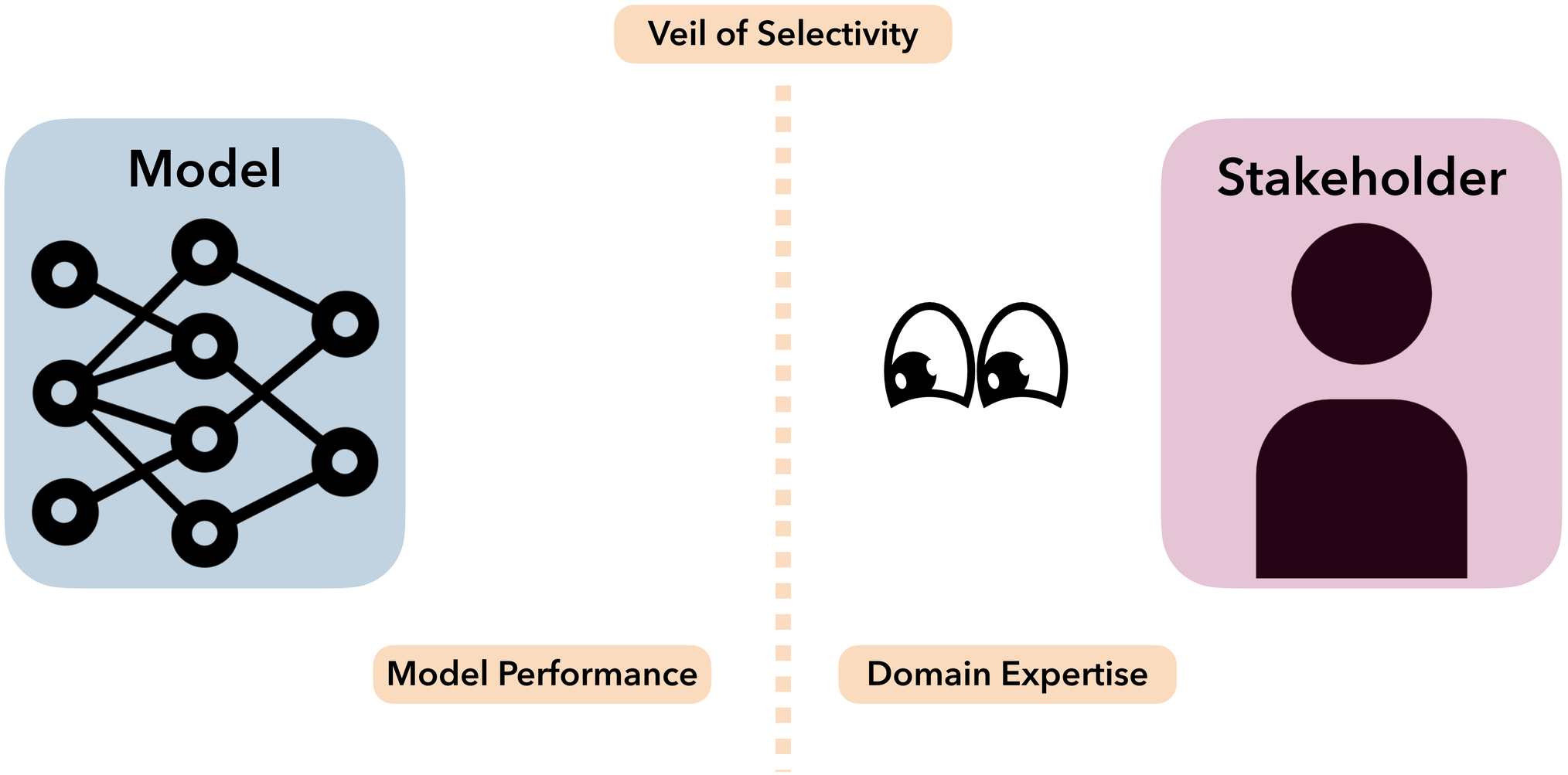

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Outline

I. What is *Algorithmic Resignation*?

II. Benefits of *Algorithmic Resignation*

III. Considerations for *Algorithmic Resignation*

IV. *Algorithmic Resignation* in Practice

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Algorithmic resignation is the *deliberate* and *informed* disengagement from AI assistance in certain scenarios.

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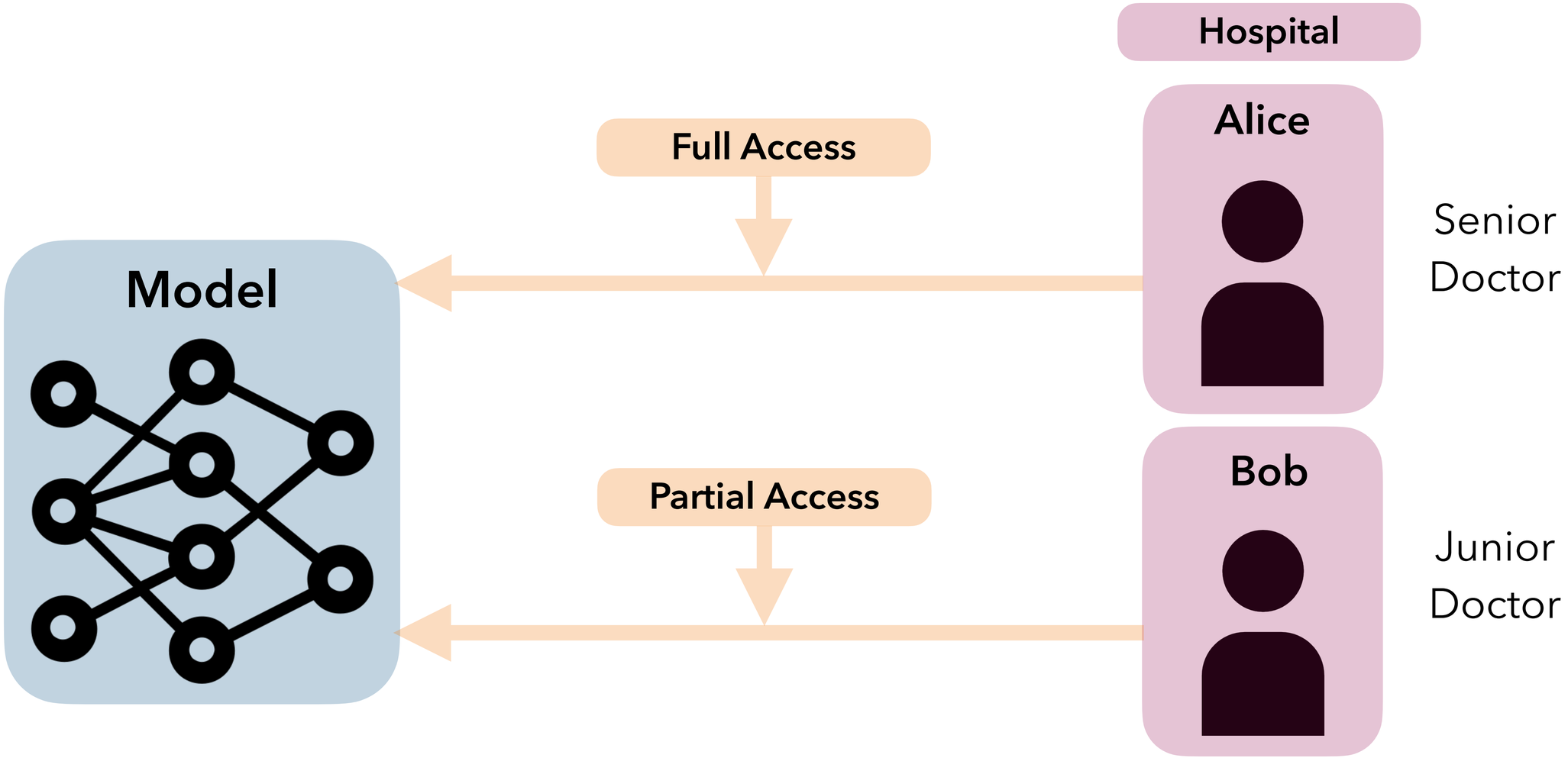

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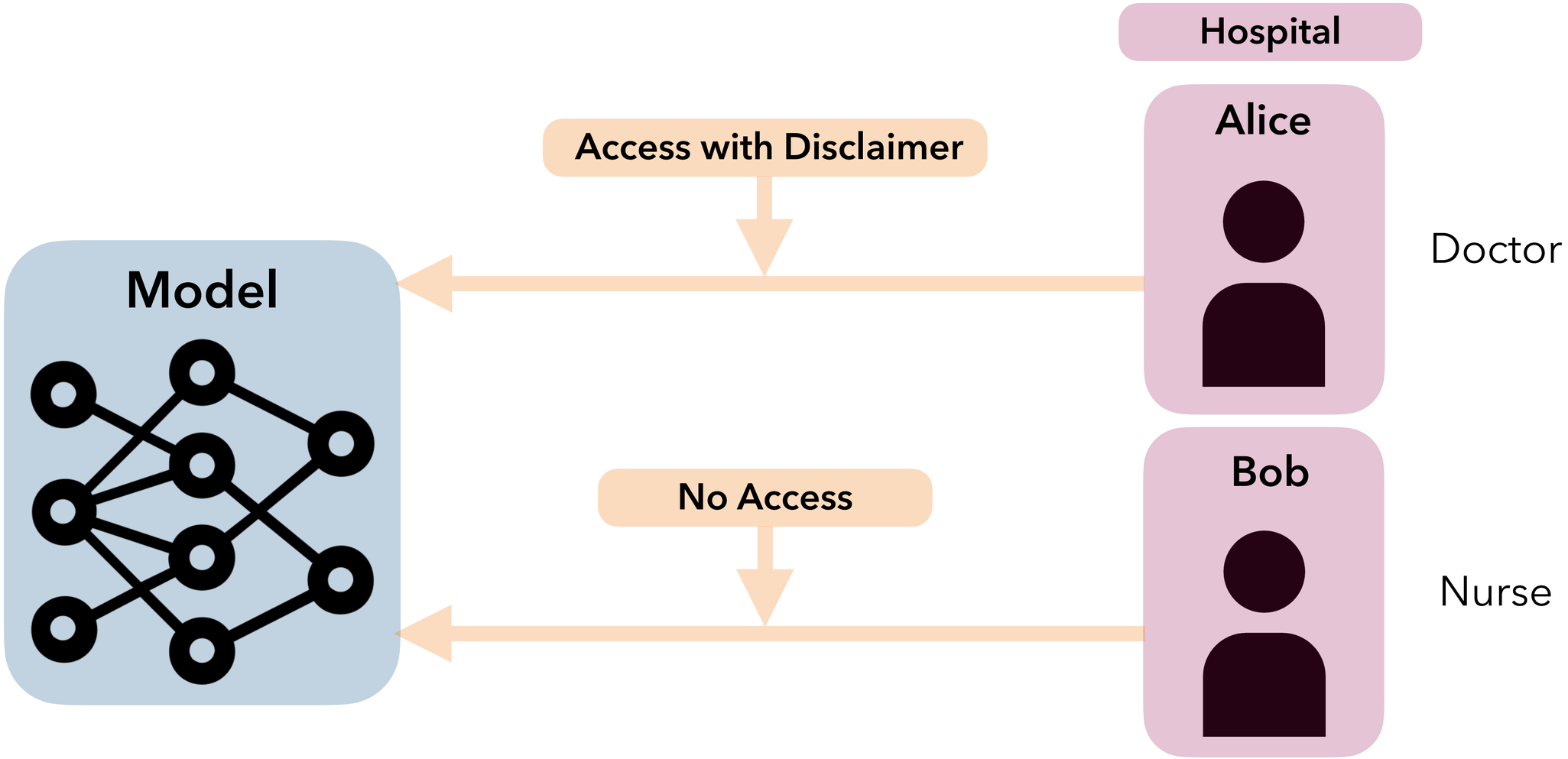

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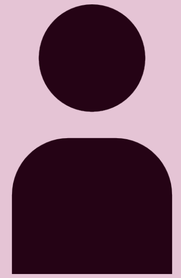
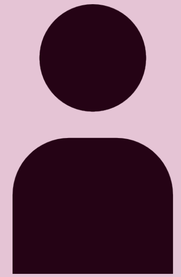
Hospital

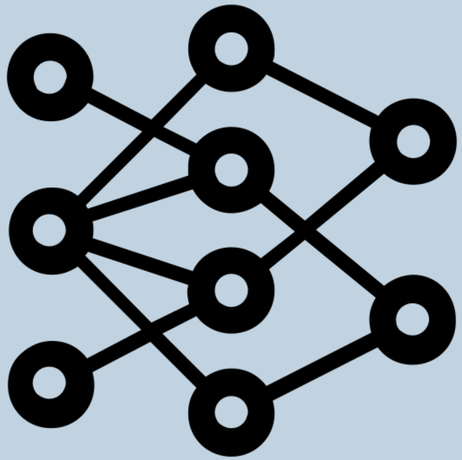
Alice



Bob



Model



Appropriate Access

Cost

Expertise

Internal Policy

External Regulation

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Algorithmic resignation goes beyond the disuse of AI systems.

It is about embedding **governance** mechanisms directly within AI systems, guiding when and how these systems should be used or abstained from.

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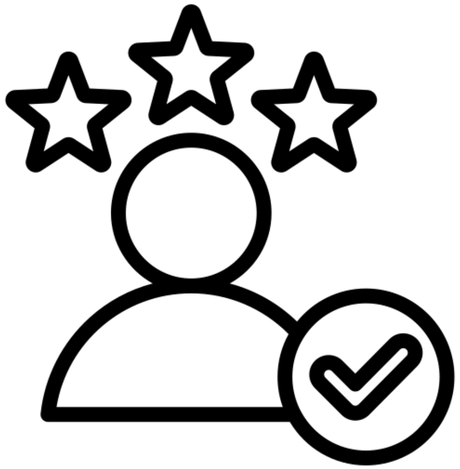
Benefits of Algorithmic Resignation

Economic Efficiency



Reputational Gain

Legal Compliance

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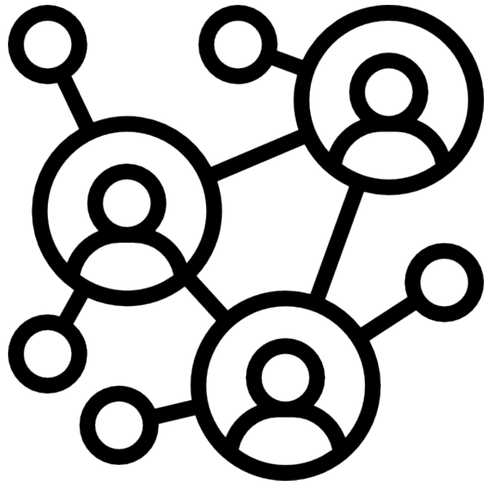
Considerations for Algorithmic Resignation

Directionality of Selectivity



Stakeholder Incentives

Level of Engagement

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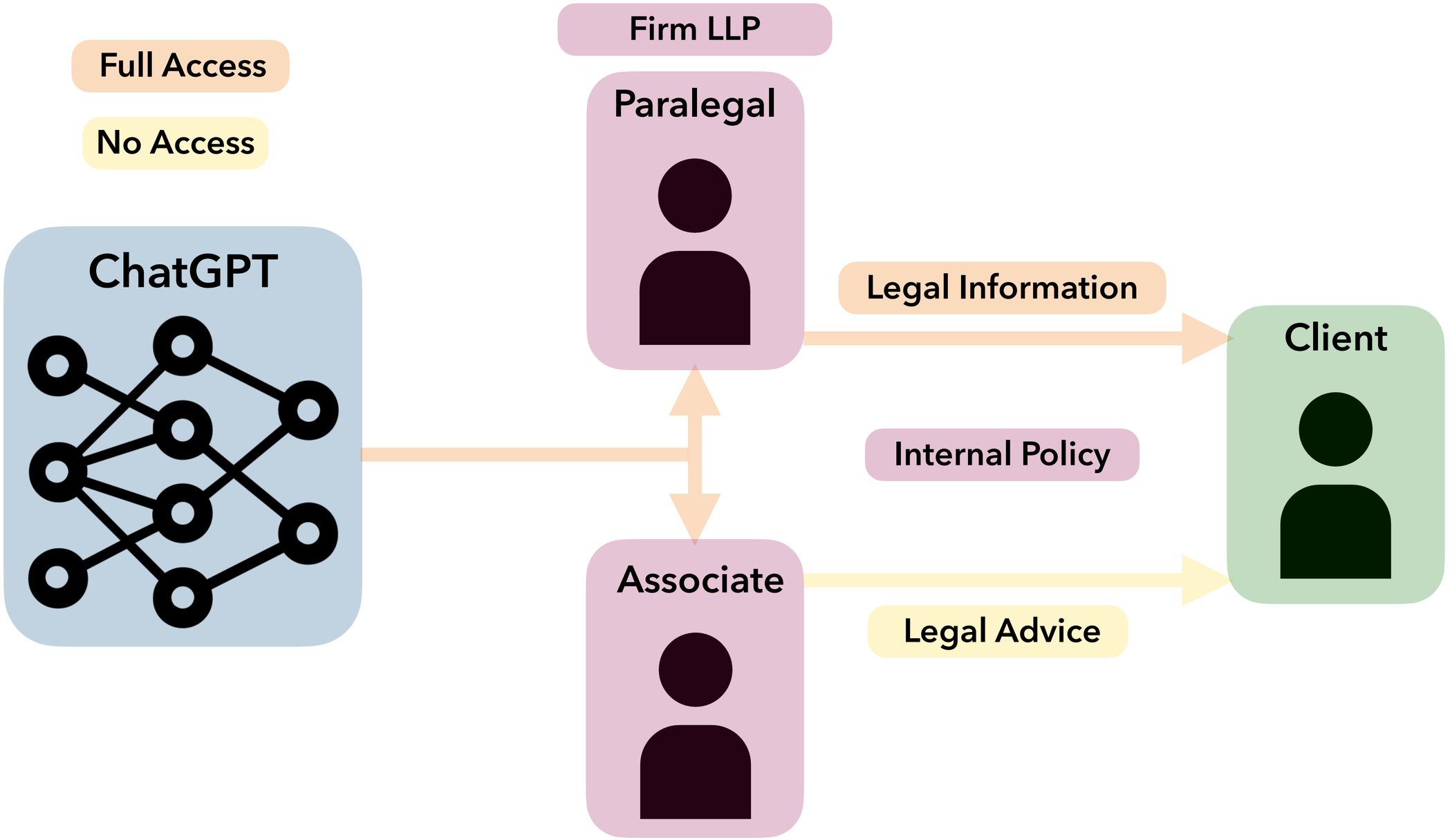

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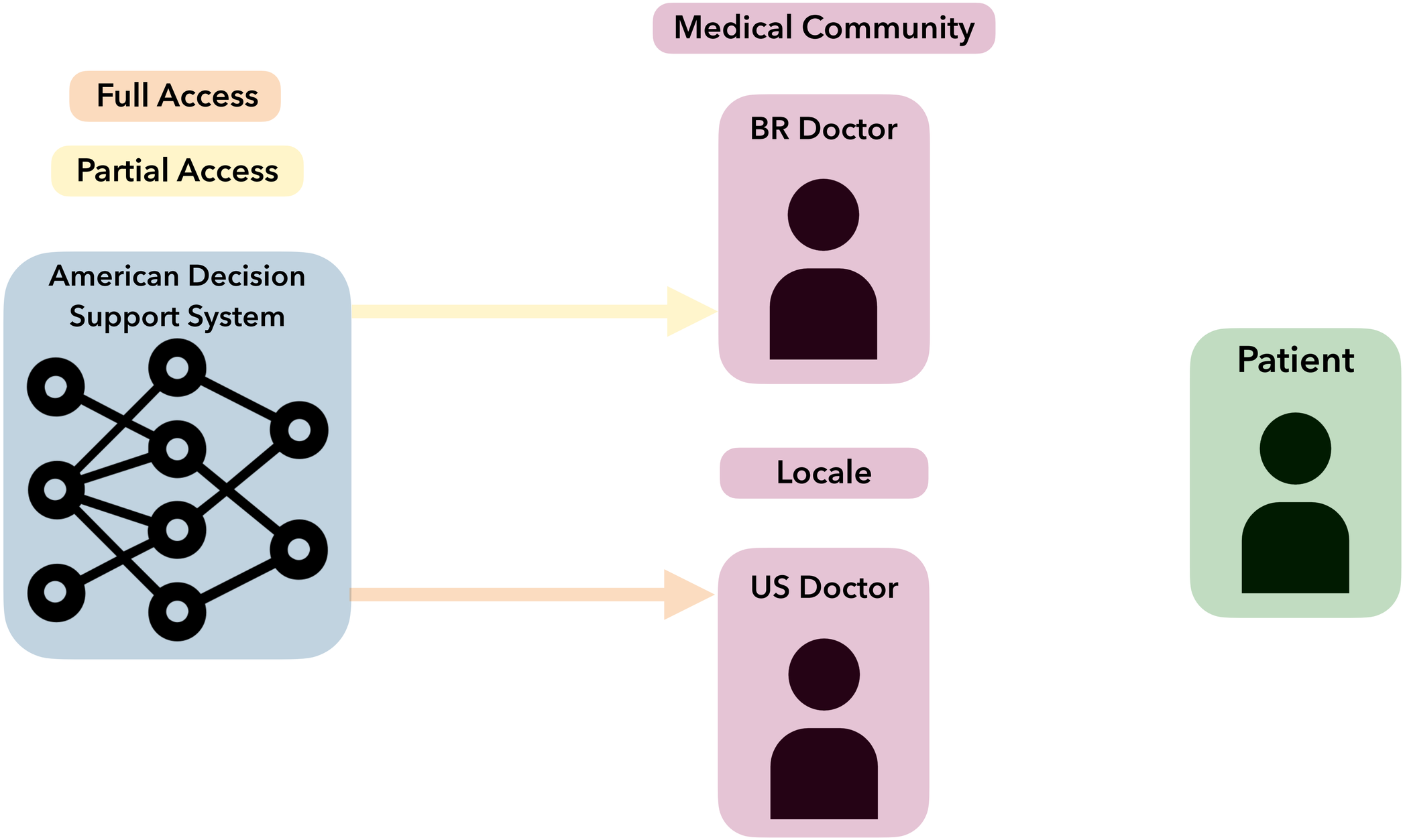

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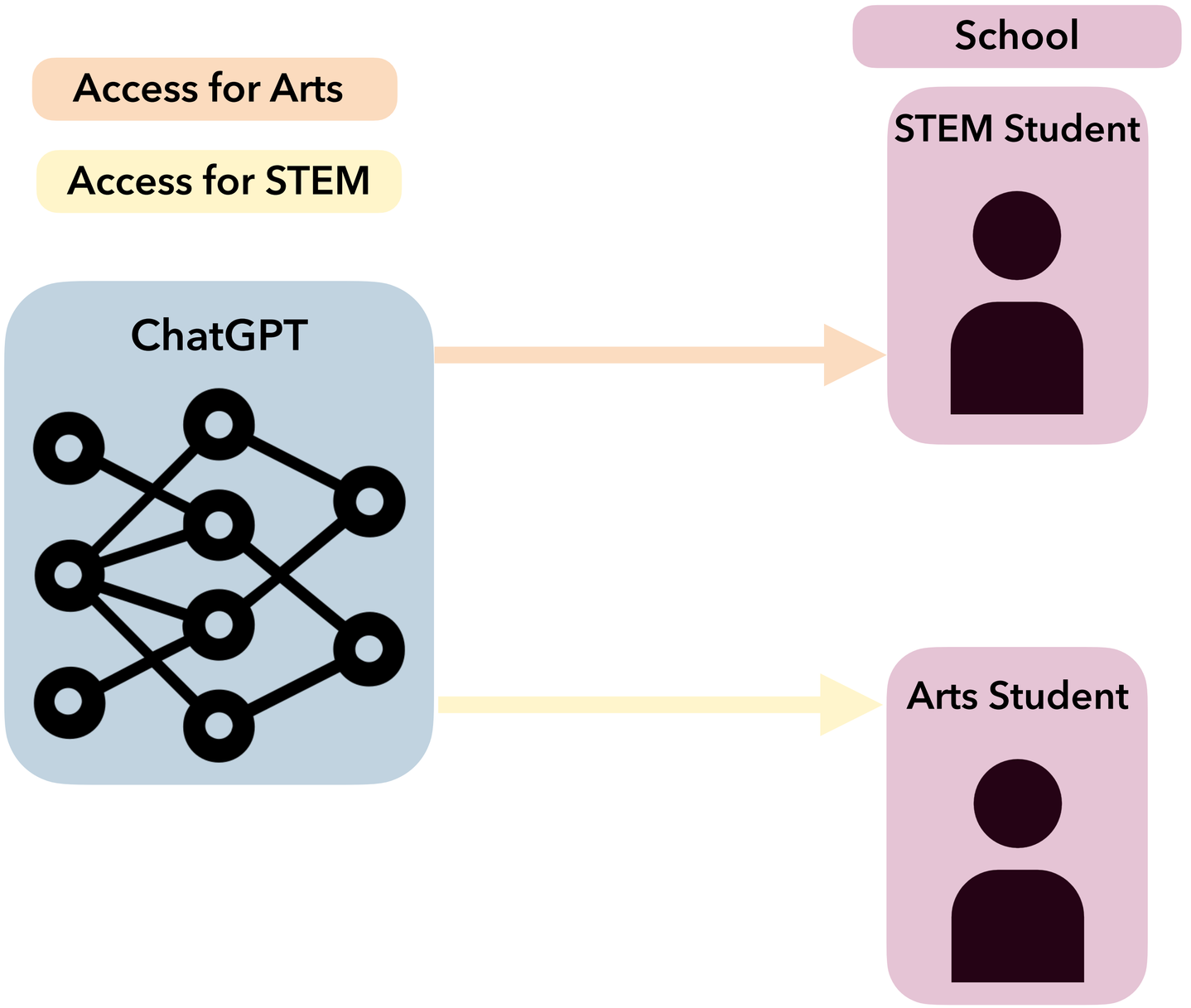

1. Different students will need different levels of support
2. Access to support can be learned over a series of interactions
3. Access may be complementary to expertise

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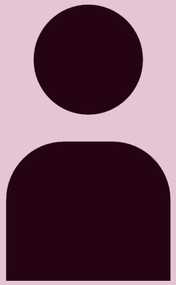
Student



Personalize Access

Learning Personalized Decision Support Policies

Methods

Question: *"When is it appropriate to provide decision support (e.g. ML model predictions) to a specific decision-maker?"*

x_t

Forms of support

a_1 = **None**

a_2 = **ML Prediction**

a_3 = **LLM Summary**

Decision-maker

$\pi_t^{Alice}(x_t) = a_2$

$\tilde{y}_t = h_{Alice}(x_t, a_2)$

Update π_{t+1}^{Alice} using $\ell(\tilde{y}_t, y_t)$

Formulation: *For an unseen decision-maker, which available form of decision support would improve their decision outcome performance the most?*

Set Up

We select a form of support $a_t \in A$ using a decision support policy $\pi_t : X \to \Delta(A)$

The decision-maker makes the final prediction: $\tilde{y}_t = h(x_t, a_t)$

Performance differs under each form of support: $r_{A_i}(x; h) = \mathbb{E}_{y|x}[\ell(y, h(x, A_i))]$

Core Idea of THREAD

Learn policy π_t using a exisiting contextual bandits techniques

Include cost of a_t in the objective

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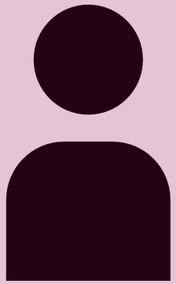
Student



Personalize Access

Learning Personalized Decision Support Policies

Methods

MMLU Task: *60 questions from 4 categories*

Computer Science, Elementary Math, Biology, Foreign Policy

Expertise Profiles

Invariant: $r_{A_1}(X_j; h) \approx r_{A_2}(X_j; h), \forall j \in [N]$

Varying: $r_{A_1}(X_j; h) \leq r_{A_2}(X_j; h)$ and $r_{A_2}(X_k; h) \leq r_{A_1}(X_k; h)$

Strictly Better: $r_{A_1}(X_j; h) \leq r_{A_2}(X_j; h), \forall j \in [N]$

Excess loss over optimal loss

MMLU

Algorithm	Invariant	Strictly Better	Varying
H-ONLY	0.01 ± 0.01	0.18 ± 0.17	0.22 ± 0.12
H-LLM	0.01 ± 0.01	0.18 ± 0.21	0.12 ± 0.17
Population	0.00 ± 0.02	0.19 ± 0.07	0.12 ± 0.09
THREAD-LinUCB	0.00 ± 0.01	0.12 ± 0.03	0.07 ± 0.04
THREAD-KNN	0.01 ± 0.01	$\mathbf{0.05 \pm 0.03}$	$\mathbf{0.05 \pm 0.03}$

If a decision-maker benefits from having support some of the time, we can learn their policy online

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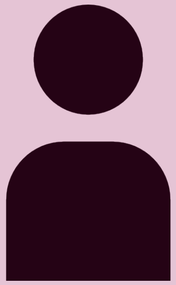
Student



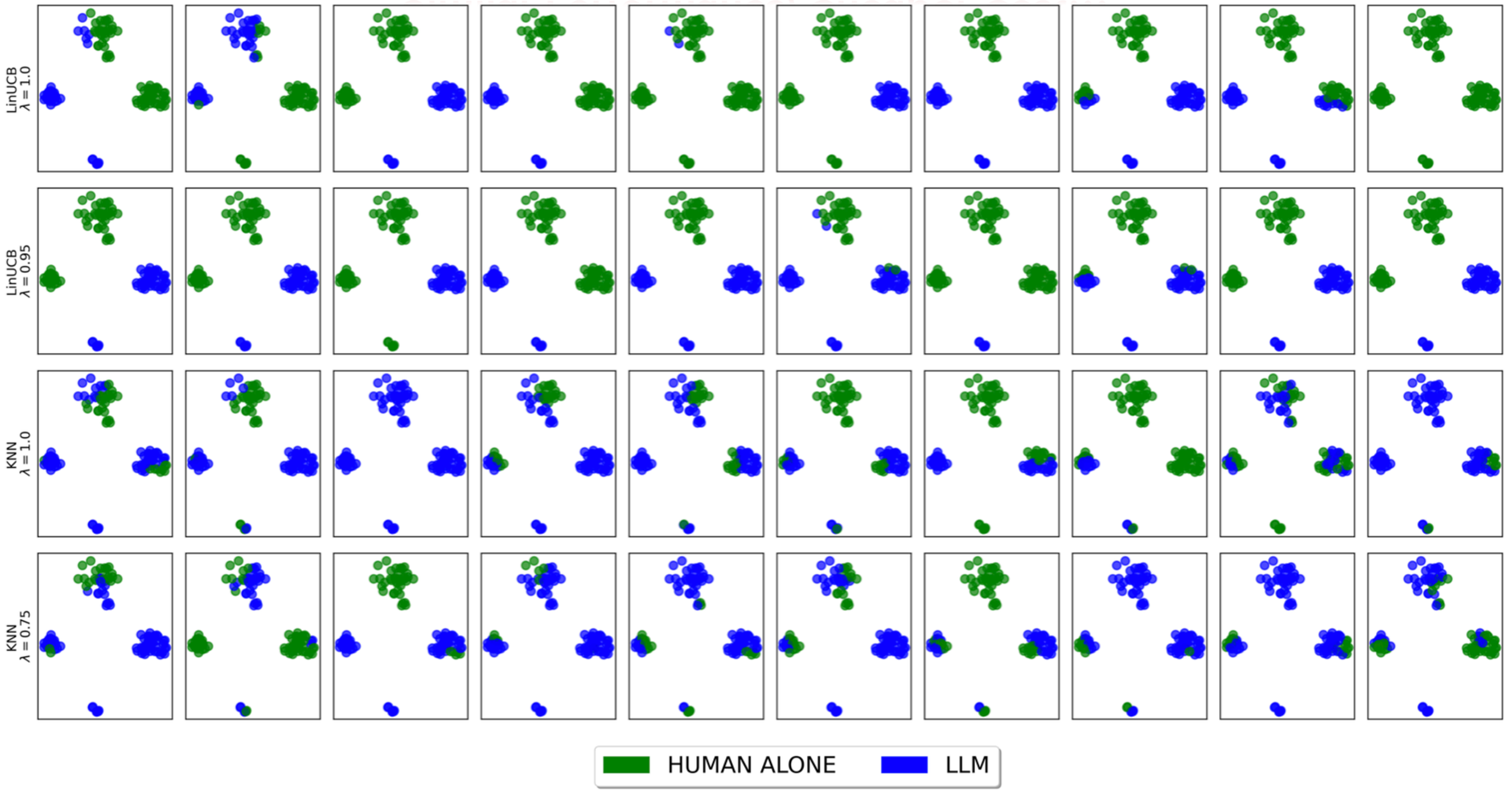
Personalize Access

Learning Personalized Decision Support Policies

User Studies

Interactive Evaluation: Users interact with our tool, **Modiste**, which uses THREAD to learn when users require support online.

Similar Performance, Cheaper Cost!!!



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Takeaways

Resignation is a new mechanism for self-regulating (e.g., corporate compliance can establish policies to restrict AI use).

Algorithmic resignation orchestrates human-machine collaboration to improve outcomes and processes (e.g., AI-powered content moderation tools may only escalate content to human moderators as and when needed).

Personalized access to decision support (e.g., ML models) can be learned and improve decision-maker performance.

When Should Algorithms Resign?

Thank you to my collaborators!


John Zerilli
Edinburgh


P. Kamalaruban
Turing


Emma Kallina
Cambridge


Katie Collins
Cambridge


Adrian Weller
Cambridge


Holli Sargeant
Berkman Klein

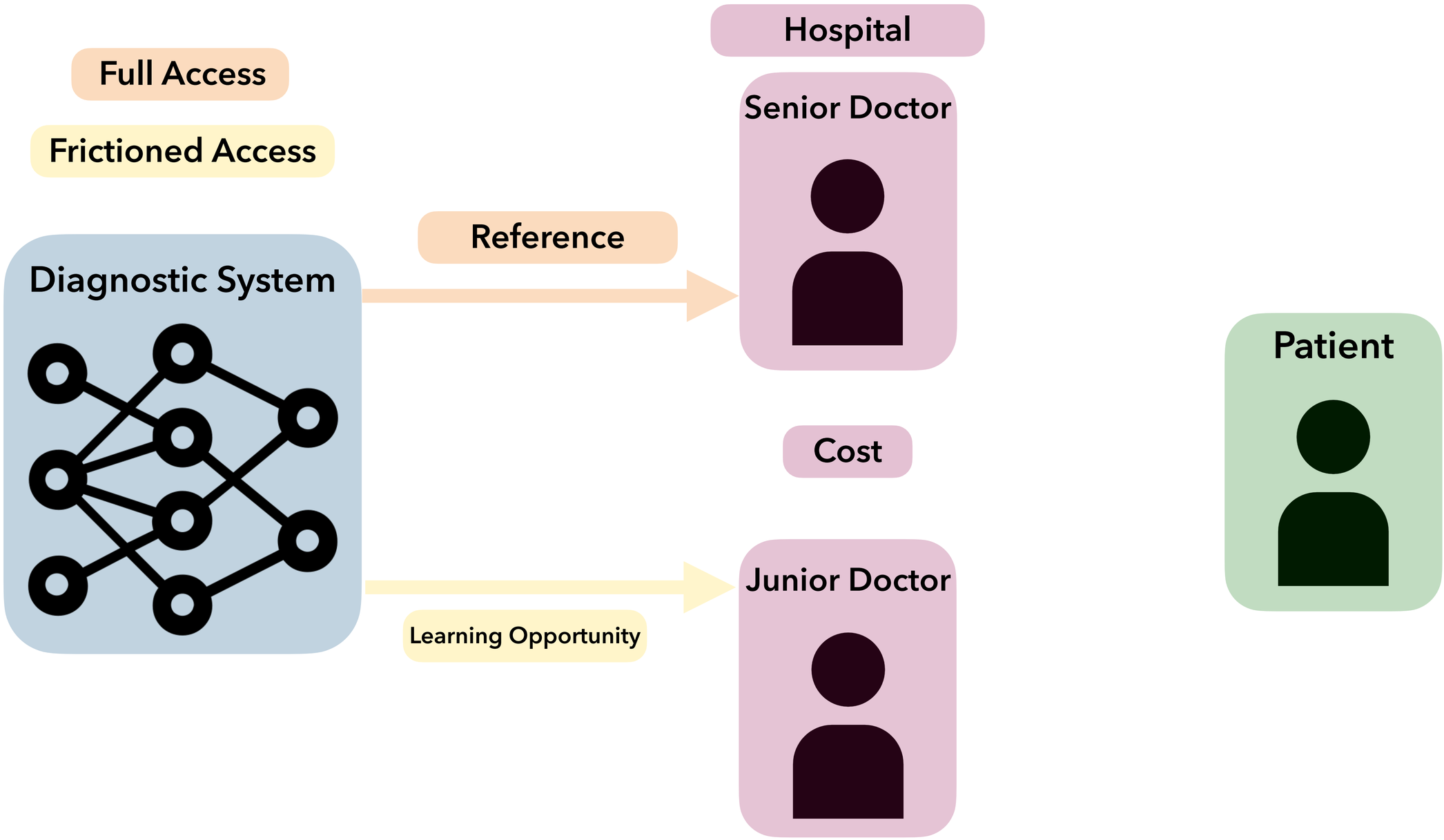

Valerie Chen
CMU


Ameet Talwalkar
CMU

@umangsbhatt

umangbhatt@nyu.edu

Appendix



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Strictly Better: $r_{A_1}(X_j; h) \leq r_{A_2}(X_j; h), \forall j \in [N]$

CIFAR10 Task: *3 forms of support (None, Model, or Expert Consensus) and 5 classes*

MMLU Task: *2 forms of support (None or LLM) and 4 categories*

CIFAR

Excess loss over optimal loss

Algorithm	Invariant	Strictly Better	Varying
H-Only	0.00 ± 0.01	0.09 ± 0.08	0.50 ± 0.06
H-Model	0.00 ± 0.01	0.22 ± 0.19	0.35 ± 0.05
H-Consensus	0.00 ± 0.01	0.23 ± 0.13	0.27 ± 0.08
Population	0.00 ± 0.02	0.18 ± 0.08	0.15 ± 0.03
THREAD-LinUCB	0.00 ± 0.01	0.17 ± 0.05	0.19 ± 0.05
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MMLU

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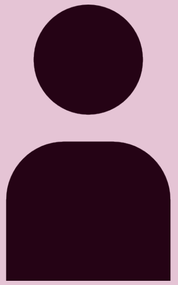
Learning Personalized Decision Support Policies

User Studies

Decision Maker



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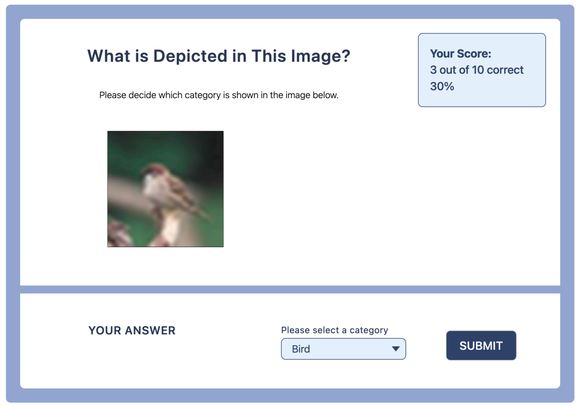

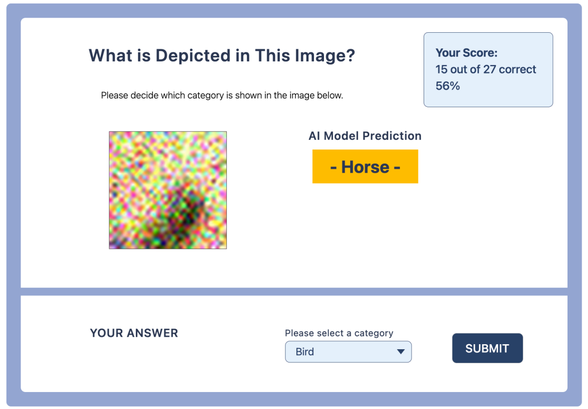

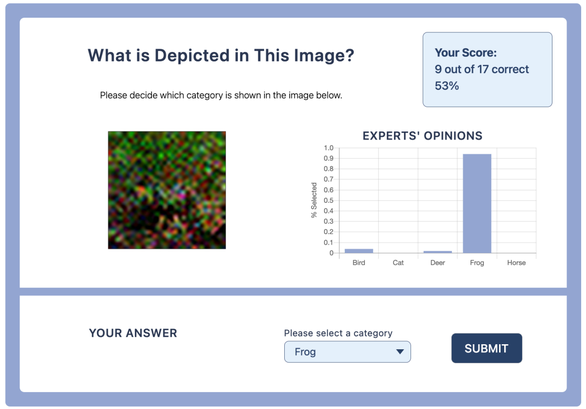

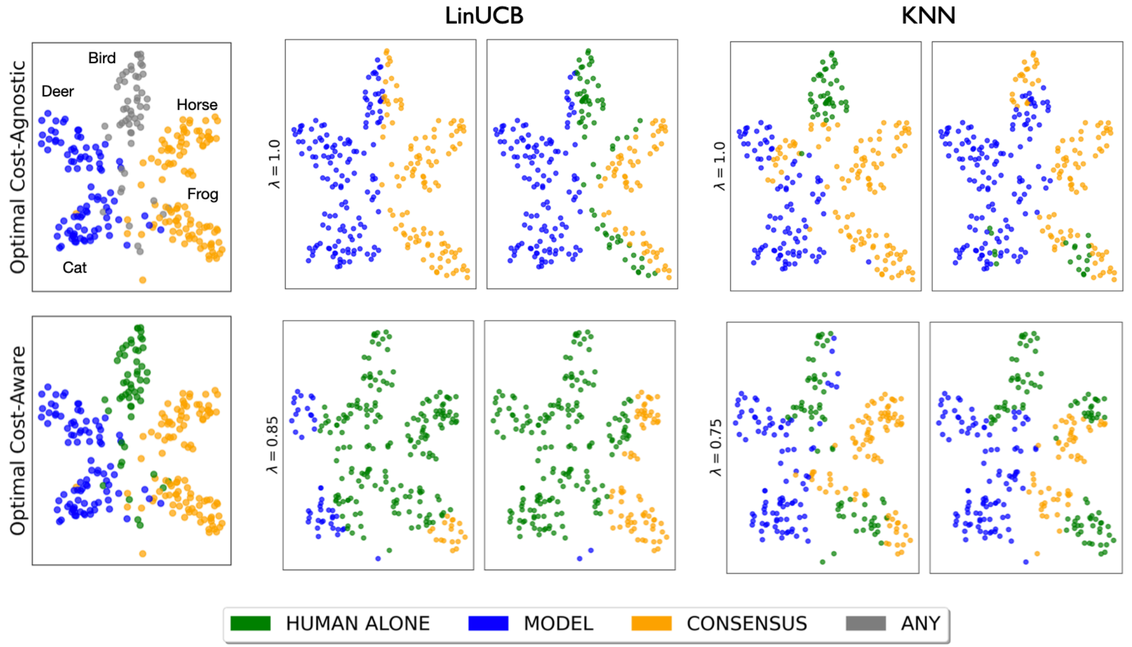

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