



EDUCATIONAL RESOURCES

# AI Foundations for Pharmacy Teams

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 PHARMACY



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# Welcome

- Thinking about artificial intelligence
- Applications of AI in pharmacy
- Assessing opportunities
- Optimization techniques
- Practical application



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# intelligence

# Artificial intelligence

<p><b>Thinking Humanly</b></p> <p>“The exciting new effort to make computers think . . . <i>machines with minds</i>, in the full and literal sense.” (Haugeland, 1985)</p> <p>“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)</p>	<p><b>Thinking Rationally</b></p> <p>“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)</p> <p>“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)</p>
<p><b>Acting Humanly</b></p> <p>“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)</p> <p>“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)</p>	<p><b>Acting Rationally</b></p> <p>“Computational Intelligence is the study of the design of intelligent agents.” (Poole <i>et al.</i>, 1998)</p> <p>“AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)</p>

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# Which definition is the Turing test testing?

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- Remember what it knows
- Remember what it hears
- Use information to draw conclusion and answer questions
- Adjust to new situations
- Detect and extrapolate patterns



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- Communicate in English
- Remember what it knows
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- Use information to draw conclusion and answer questions
- Adjust to new situations
- Detect and extrapolate patterns
- Natural language processing
- Knowledge representation
- Knowledge representation
- Automated reasoning
- Machine learning
- Machine learning

# What capabilities does a computer need?

- Perceive objects
- Move objects
- Computer vision
- Robotics

# How do we know how humans think?

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# Foundations of Artificial Intelligence

- Philosophy - Can formal rules be used to draw valid conclusions? Where does knowledge come from? How does knowledge lead to action?
- Mathematics - What are the formal rules to draw valid conclusions? What can be computed? How do we reason with uncertain information?
- Economics - How should we make decisions so as to maximize payoff? How should we do this when others may not go along? How should we do this when payoff may be far in the future? Operations research; Markov decision process
- Neuroscience - How do brains process information?
- Psychology - How do humans and animals think and act?
- Computer engineering - How can we build an efficient computer?
- Control theory and cybernetics - How can artifacts operate under their own control? calculus, matrix algebra are the tools of control theory
- Linguistics - How does language relate to thought?

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<b>Thinking Humanly</b>  Providing empathetic support for a patient overwhelmed with their medication regimen.	<b>Thinking Rationally</b>
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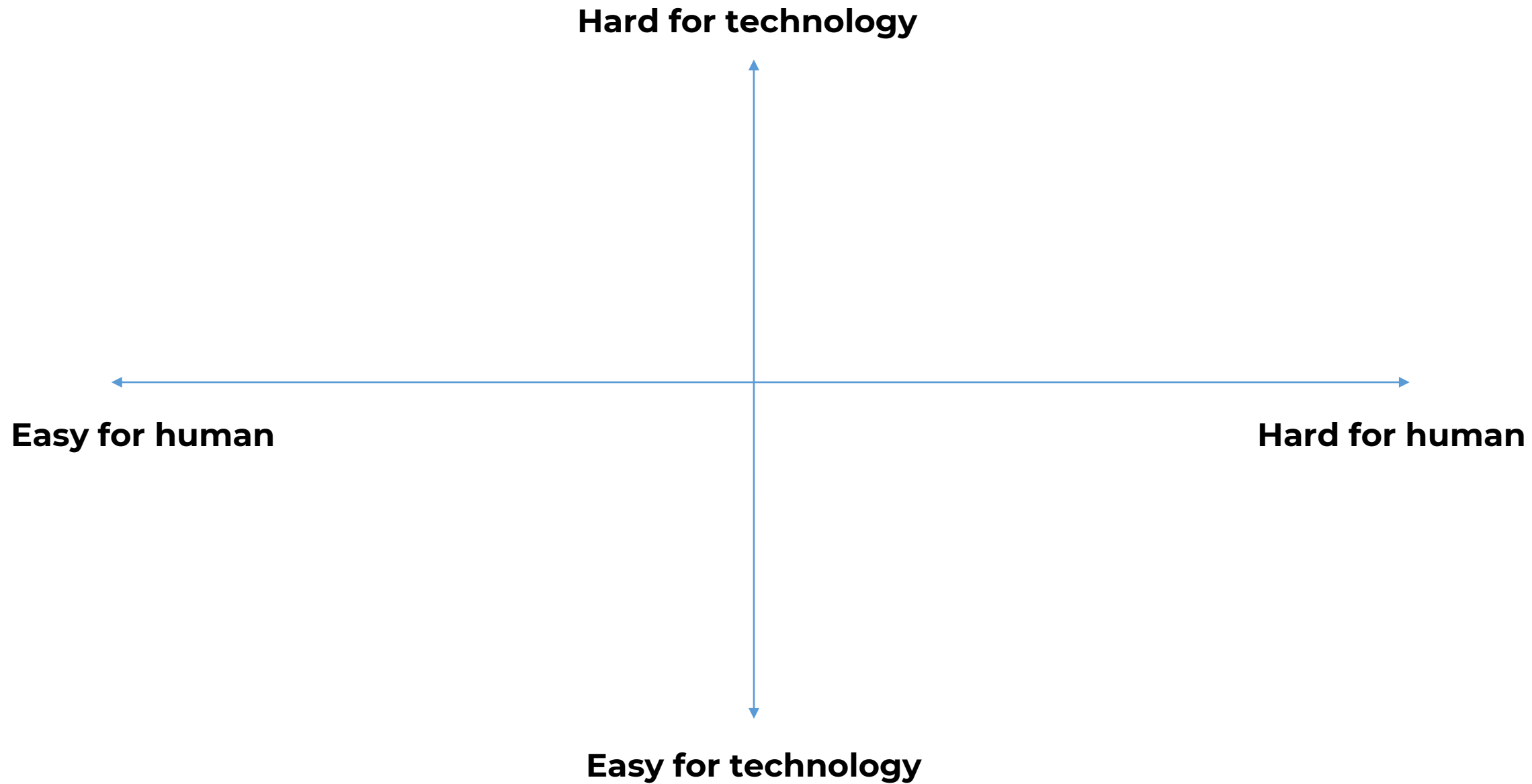
<b>Thinking Humanly</b>  Providing empathetic support for a patient overwhelmed with their medication regimen.	<b>Thinking Rationally</b>  Recommending a treatment based on all the knowledge that's available such as clinical guidelines, how different factors (e.g., gender, age, comorbidities, genetics, preferences, concerns, previous treatment) affect the response to a treatment.
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<b>Acting Humanly</b>  Conversing freely like humans. Uses friendly language.	<b>Acting Rationally</b>  Achieving an optimal inventory level by predicting medication demand based on historical data, seasonal trends, and current usage patterns.

# Applications of AI in Pharmacy

- Recommend an optimal treatment
- Predict issues with medications
- Identify the best time to outreach to patients
- Tailor the education to the specific individual
- Provide support 24/7 in multiple languages to answer FAQs or resolve tasks
- Chart review to identify diagnosis and previous treatment
- Clinician decision support for drug information, regulations, etc.
- Draft policies and procedures
- No-code data analytics with chat as user interface



## Hard for technology

- Open-ended conversations

- Have expert clinical knowledge
- Personalize conversations based on learned patient characteristics

## Easy for human

- Conversation that sounds natural
- Static one-way messages

## Hard for human

- Remember every relevant detail about the patient
- Be available 24/7
- Converse in 50 languages
- Analyze large amount of data and synthesize insights

## Easy for technology

# Implementation Considerations

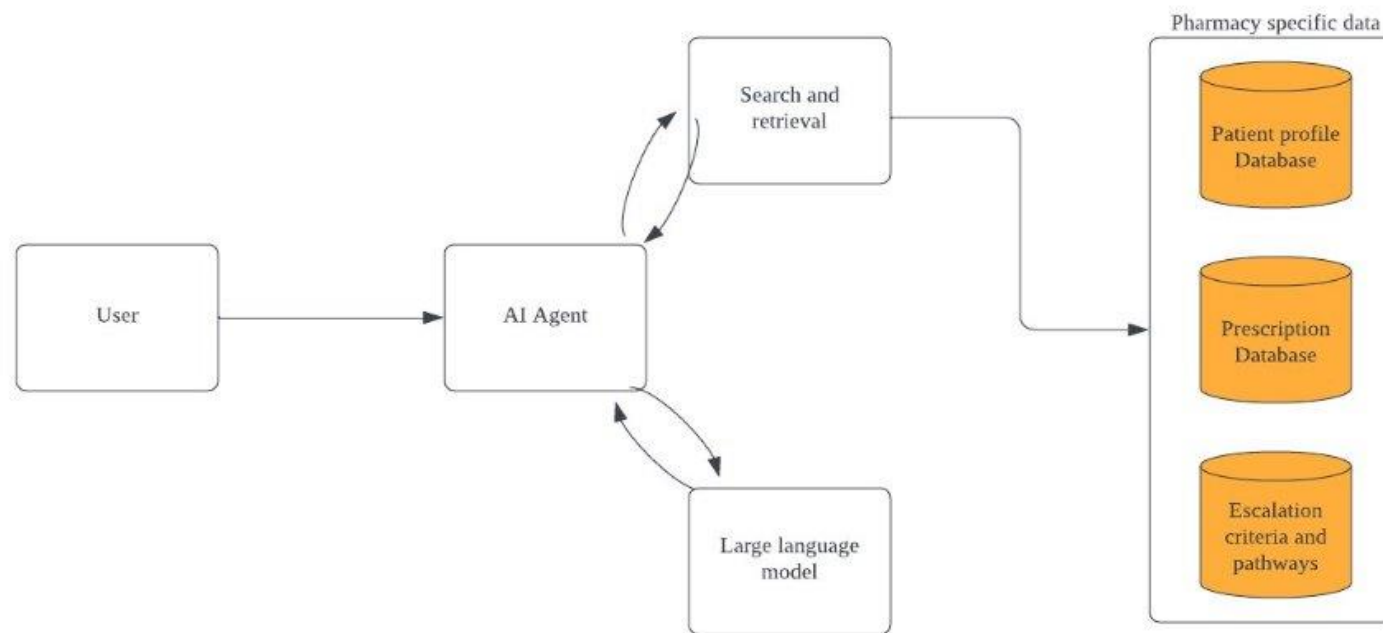
- Problem and goal
- Return on investment
- Reimbursement policies
- Regulations
- Handling sensitive data
- Bias and ethical concerns
- Complexity of terminology
- Accuracy and reliability of information



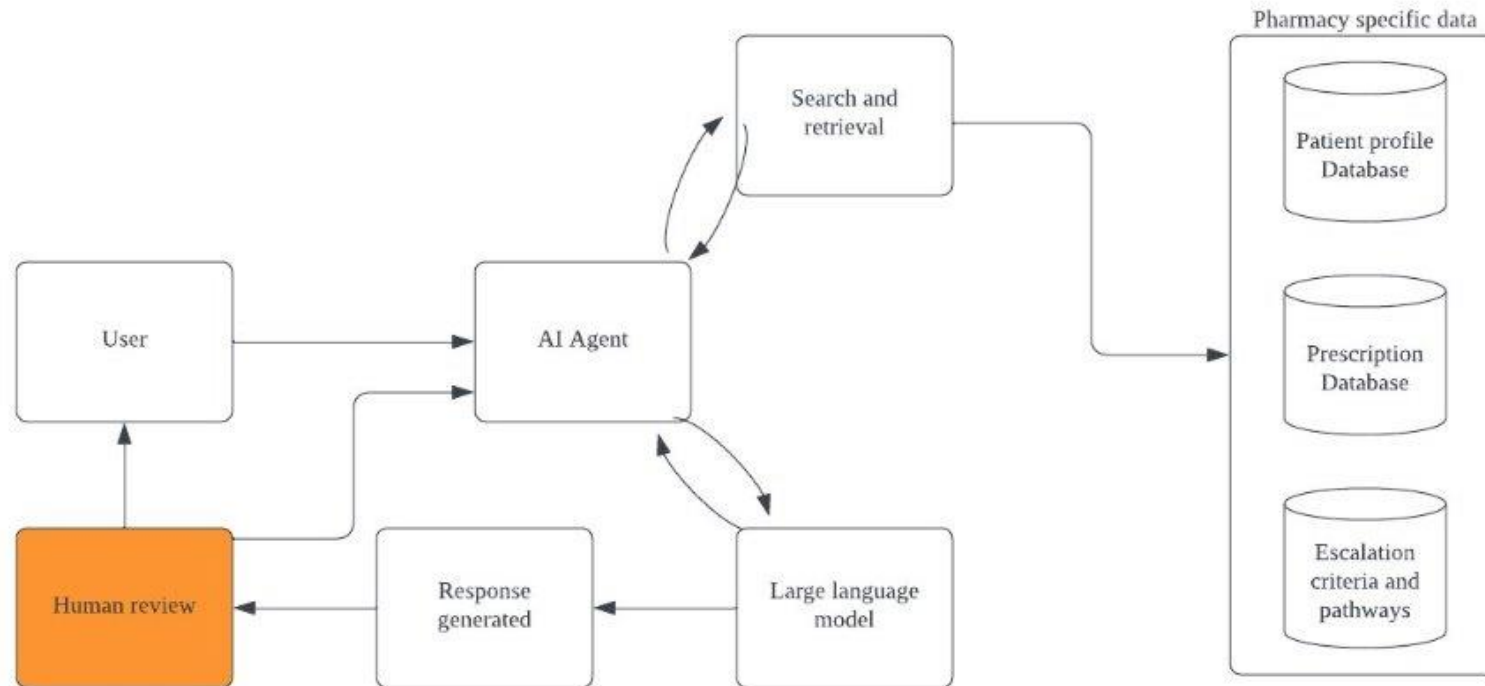
# Optimization Techniques

- Retrieval augmented generation
- Human-in-the-loop
- Fine tuning

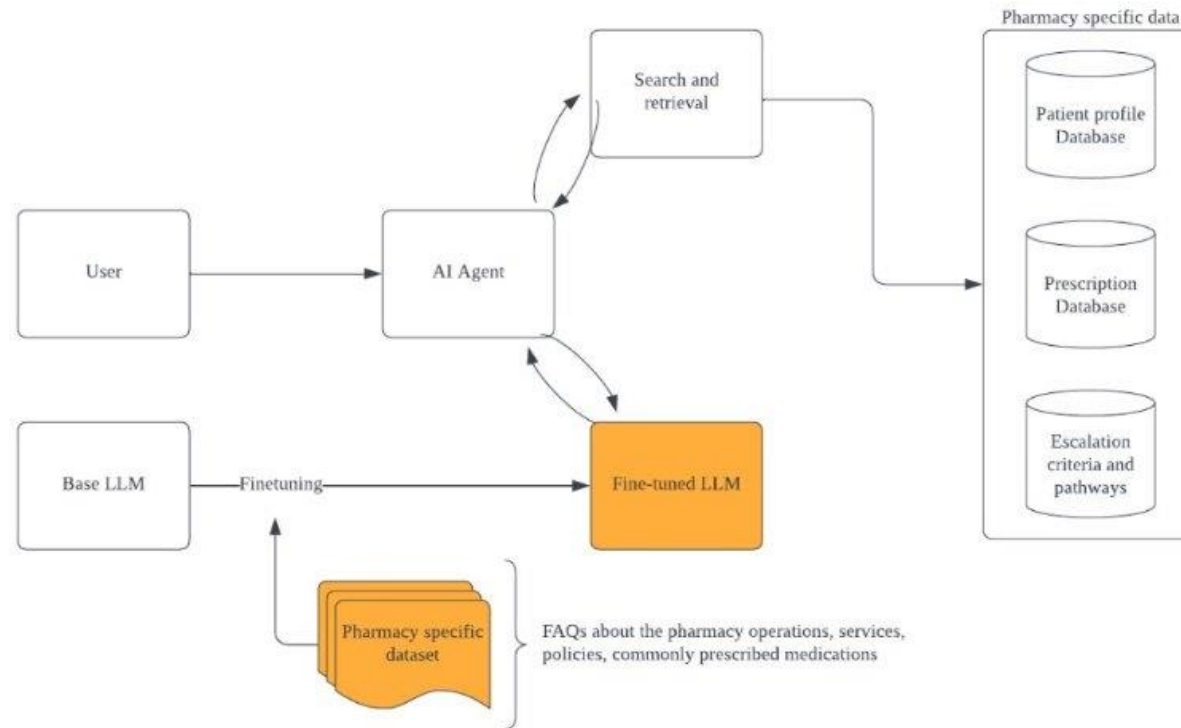
# Retrieval Augmented Generation



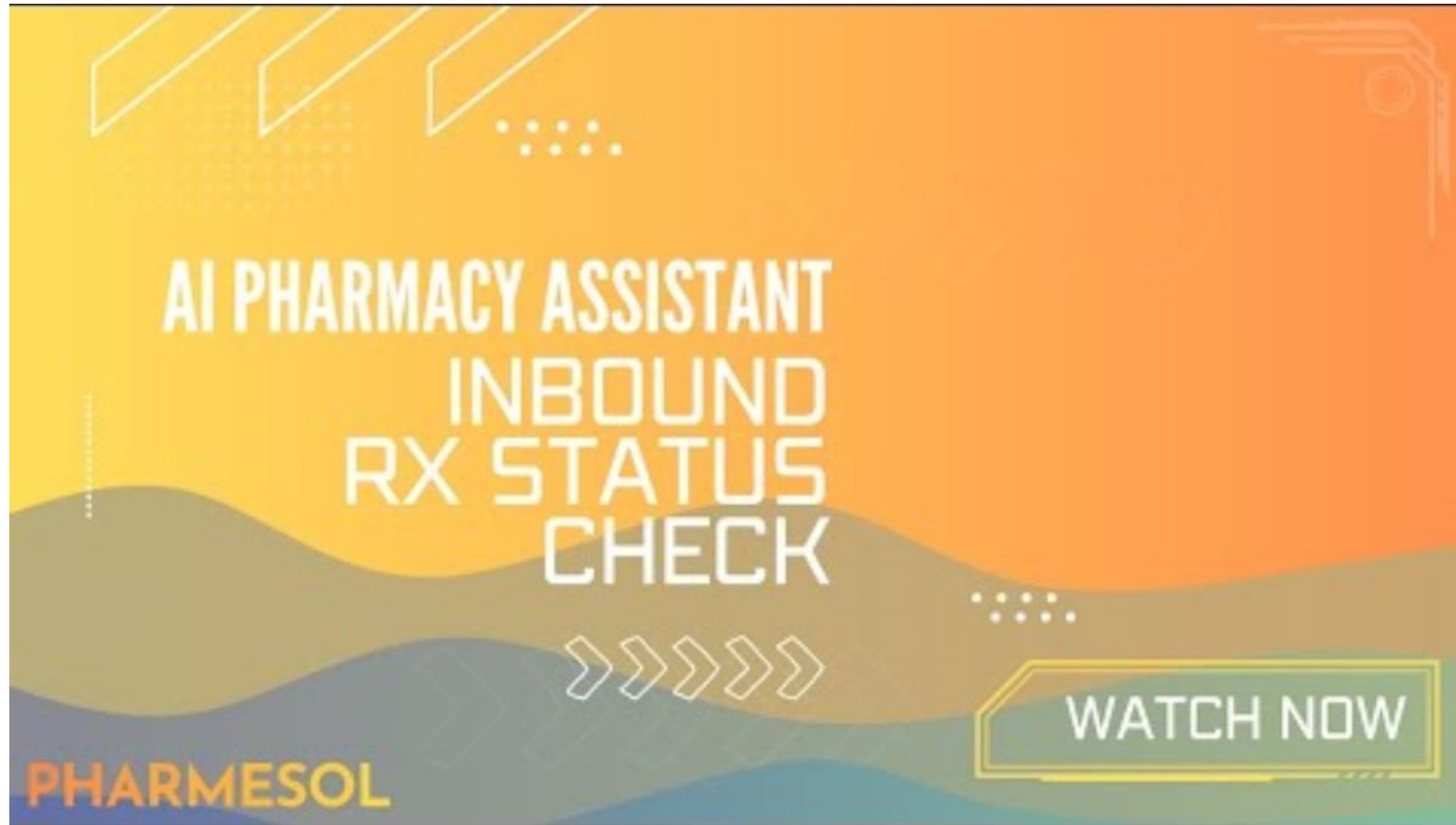
# Human-In-The-Loop



# Fine Tuning



# Automating Phone Calls



# Automating Phone Calls

- Leveraging information sources such as pharmacy management system, pharmacy specific workflows and policies, FDA labels, and custom knowledge library.
- Using large language models with other system components to automate workflows such as phone calls, messaging, and documentation for pharmacy teams.
- Pharmacies benefit from supporting large volume of calls at the same time, answering inbound calls immediately, providing 24/7 concierge-like experience with after-hours availability, increased touchpoints, and patient satisfaction.



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# Thank you

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