

# Four Example Application Domains

- **Autonomous delivery robot** roams around an office environment and delivers coffee, parcels, . . .

# Four Example Application Domains

- **Autonomous delivery robot** roams around an office environment and delivers coffee, parcels, . . .
- **Diagnostic assistant** helps a human troubleshoot problems and suggests repairs or treatments. E.g., electrical problems, medical diagnosis.

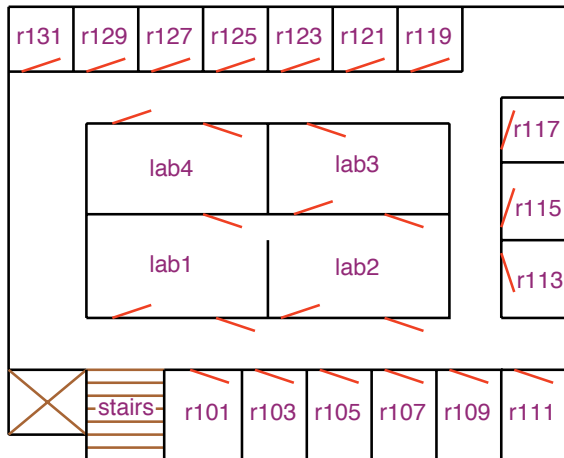
# Four Example Application Domains

- **Autonomous delivery robot** roams around an office environment and delivers coffee, parcels, . . .
- **Diagnostic assistant** helps a human troubleshoot problems and suggests repairs or treatments. E.g., electrical problems, medical diagnosis.
- **Intelligent tutoring system** teaches students in some subject area.

# Four Example Application Domains

- **Autonomous delivery robot** roams around an office environment and delivers coffee, parcels, . . .
- **Diagnostic assistant** helps a human troubleshoot problems and suggests repairs or treatments. E.g., electrical problems, medical diagnosis.
- **Intelligent tutoring system** teaches students in some subject area.
- **Trading agent** buys goods and services on your behalf.

# Domain for Delivery Robot



# Autonomous Delivery Robot

Example inputs:

- **Abilities:**

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:**



# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.
- **Past experience:**

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.
- **Past experience:** which actions are useful and when, what objects are there, how its actions affect its position.

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.
- **Past experience:** which actions are useful and when, what objects are there, how its actions affect its position.
- **Goals:**

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.
- **Past experience:** which actions are useful and when, what objects are there, how its actions affect its position.
- **Goals:** what it needs to deliver and when, tradeoffs between acting quickly and acting safely.
- **Stimuli:** about its environment from

# Autonomous Delivery Robot

Example inputs:

- **Abilities:** movement, speech, pickup and place objects.
- **Prior knowledge:** its capabilities, objects it may encounter, maps.
- **Past experience:** which actions are useful and when, what objects are there, how its actions affect its position.
- **Goals:** what it needs to deliver and when, tradeoffs between acting quickly and acting safely.
- **Stimuli:** about its environment from cameras, sonar, sound, laser range finders, or keyboards.

# What does the Delivery Robot need to do?

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .



# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.
- Make default assumptions about where Craig is.

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.
- Make default assumptions about where Craig is.
- Make tradeoffs under uncertainty: should it go near the stairs?

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.
- Make default assumptions about where Craig is.
- Make tradeoffs under uncertainty: should it go near the stairs?
- Learn from experience.

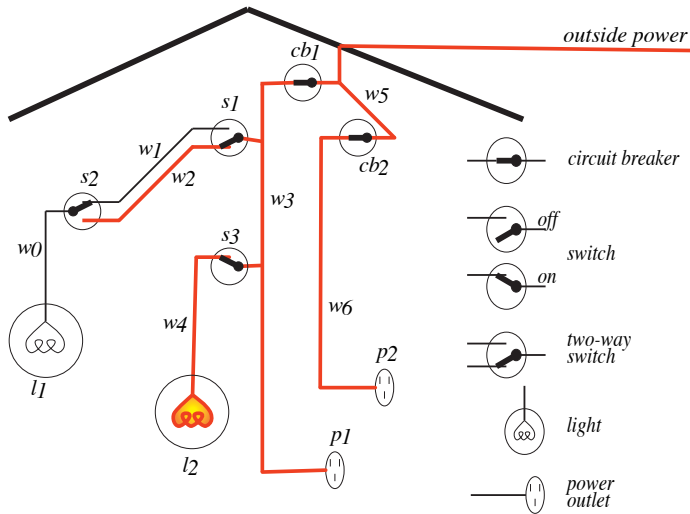
# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.
- Make default assumptions about where Craig is.
- Make tradeoffs under uncertainty: should it go near the stairs?
- Learn from experience.
- Sense the world, avoid obstacles, pickup and put down coffee.

# What does the Delivery Robot need to do?

- Determine where Craig's office is. Where coffee is. . .
- Find a path between locations.
- Plan how to carry out multiple tasks.
- Make default assumptions about where Craig is.
- Make tradeoffs under uncertainty: should it go near the stairs?
- Learn from experience.
- Sense the world, avoid obstacles, pickup and put down coffee.

# Domain for Diagnostic Assistant in a Smart Home





Example inputs:

- **Abilities:**

Example inputs:

- **Abilities:** recommends fixes, ask questions.

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:**

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:**

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:** the effects of repairs or treatments, the prevalence of faults or diseases.

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:** the effects of repairs or treatments, the prevalence of faults or diseases.
- **Goals:**

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:** the effects of repairs or treatments, the prevalence of faults or diseases.
- **Goals:** fixing the device and tradeoffs between fixing or replacing different components.



Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:** the effects of repairs or treatments, the prevalence of faults or diseases.
- **Goals:** fixing the device and tradeoffs between fixing or replacing different components.
- **Stimuli:**

Example inputs:

- **Abilities:** recommends fixes, ask questions.
- **Prior knowledge:** how switches and lights work, how malfunctions manifest themselves, what information tests provide, the side effects of repairs.
- **Past experience:** the effects of repairs or treatments, the prevalence of faults or diseases.
- **Goals:** fixing the device and tradeoffs between fixing or replacing different components.
- **Stimuli:** symptoms of a device or patient.

# Subtasks for the diagnostic assistant

# Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.

# Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.

# Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.

# Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.

## Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.
- Plan courses of tests and treatments to address the problems.



## Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.
- Plan courses of tests and treatments to address the problems.
- Reason about the uncertainties/ambiguities given symptoms.

## Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.
- Plan courses of tests and treatments to address the problems.
- Reason about the uncertainties/ambiguities given symptoms.
- Trade off alternate courses of action.

## Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.
- Plan courses of tests and treatments to address the problems.
- Reason about the uncertainties/ambiguities given symptoms.
- Trade off alternate courses of action.
- Learn

## Subtasks for the diagnostic assistant

- Derive the effects of faults and interventions.
- Search through the space of possible fault complexes.
- Explain its reasoning to the human who is using it.
- Derive possible causes for symptoms; rule out other causes.
- Plan courses of tests and treatments to address the problems.
- Reason about the uncertainties/ambiguities given symptoms.
- Trade off alternate courses of action.
- Learn what symptoms are associated with faults, the effects of treatments, and the accuracy of tests.

Trading agent interacts with an information environment to purchase goods and services.

- It acquires a users needs, desires and preferences.

Trading agent interacts with an information environment to purchase goods and services.

- It acquires a users needs, desires and preferences.
- It finds what goods and services are available.

Trading agent interacts with an information environment to purchase goods and services.

- It acquires a users needs, desires and preferences.
- It finds what goods and services are available.
- It purchases goods and services that fit together to fulfill a user's preferences.

Trading agent interacts with an information environment to purchase goods and services.

- It acquires a users needs, desires and preferences.
- It finds what goods and services are available.
- It purchases goods and services that fit together to fulfill a user's preferences.
- It is difficult because



Trading agent interacts with an information environment to purchase goods and services.

- It acquires a users needs, desires and preferences.
- It finds what goods and services are available.
- It purchases goods and services that fit together to fulfill a user's preferences.
- It is difficult because users preferences and what is available can change dynamically, and some items may be useless without other items.

- Abilities:

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:**

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.
- **Past experience:**

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.
- **Past experience:** how long special last, how long items take to sell out, who has good deals, what your competitors do.
- **Goals:**

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.
- **Past experience:** how long special last, how long items take to sell out, who has good deals, what your competitors do.
- **Goals:** what the person wants, their tradeoff.



# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.
- **Past experience:** how long special last, how long items take to sell out, who has good deals, what your competitors do.
- **Goals:** what the person wants, their tradeoff.
- **Stimuli:**

# Trading Agent Inputs

- **Abilities:** acquire information, make recommendations, purchase items.
- **Prior knowledge:** the ontology of what things are available, where to purchase items, how to decompose a complex item.
- **Past experience:** how long special last, how long items take to sell out, who has good deals, what your competitors do.
- **Goals:** what the person wants, their tradeoff.
- **Stimuli:** what items are available, prices, number in stock,

- Abilities:

- **Abilities:** Present information, give tests

# Intelligent Tutoring System

- **Abilities:** Present information, give tests
- **Prior knowledge:**

# Intelligent Tutoring System

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies

# Intelligent Tutoring System

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:**

# Intelligent Tutoring System

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:** common errors, effects of teaching strategies



- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:** common errors, effects of teaching strategies
- **Goals:**

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:** common errors, effects of teaching strategies
- **Goals:** the students should master subject material, gain social skills, study skills, inquisitiveness, interest

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:** common errors, effects of teaching strategies
- **Goals:** the students should master subject material, gain social skills, study skills, inquisitiveness, interest
- **Stimuli:**

- **Abilities:** Present information, give tests
- **Prior knowledge:** subject material, primitive strategies
- **Past experience:** common errors, effects of teaching strategies
- **Goals:** the students should master subject material, gain social skills, study skills, inquisitiveness, interest
- **Stimuli:** test results, facial expressions, questions, what the student is concentrating on

- **Modeling the environment** Build models of the physical environment, patient, or information environment.

# Common Tasks of the Domains

- **Modeling the environment** Build models of the physical environment, patient, or information environment.
- **Evidential reasoning or perception** Given observations, determine what the world is like.

# Common Tasks of the Domains

- **Modeling the environment** Build models of the physical environment, patient, or information environment.
- **Evidential reasoning or perception** Given observations, determine what the world is like.
- **Action** Given a model of the world and a goal, determine what should be done.

# Common Tasks of the Domains

- **Modeling the environment** Build models of the physical environment, patient, or information environment.
- **Evidential reasoning or perception** Given observations, determine what the world is like.
- **Action** Given a model of the world and a goal, determine what should be done.
- **Learning from past experiences** Learn about the specific case and the population of cases.