

# *CSCE 580: Introduction to AI* *CSCE 581: Trusted AI*

## Lecture 17: Building Chatbots

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PROF. BIPLAV SRIVASTAVA, AI INSTITUTE

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**Carolinian Creed: “I will practice personal and academic integrity.”**

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# Organization of Lecture 17

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- Introduction Segment
  - Recap of Lecture 16
- Main Segment
  - Building Chatbots
    - RASA
    - SafeChat Framework
- Concluding Segment
  - Course Project Discussion
  - About Next Lecture – Lecture 18
  - Ask me anything

# Introduction Section

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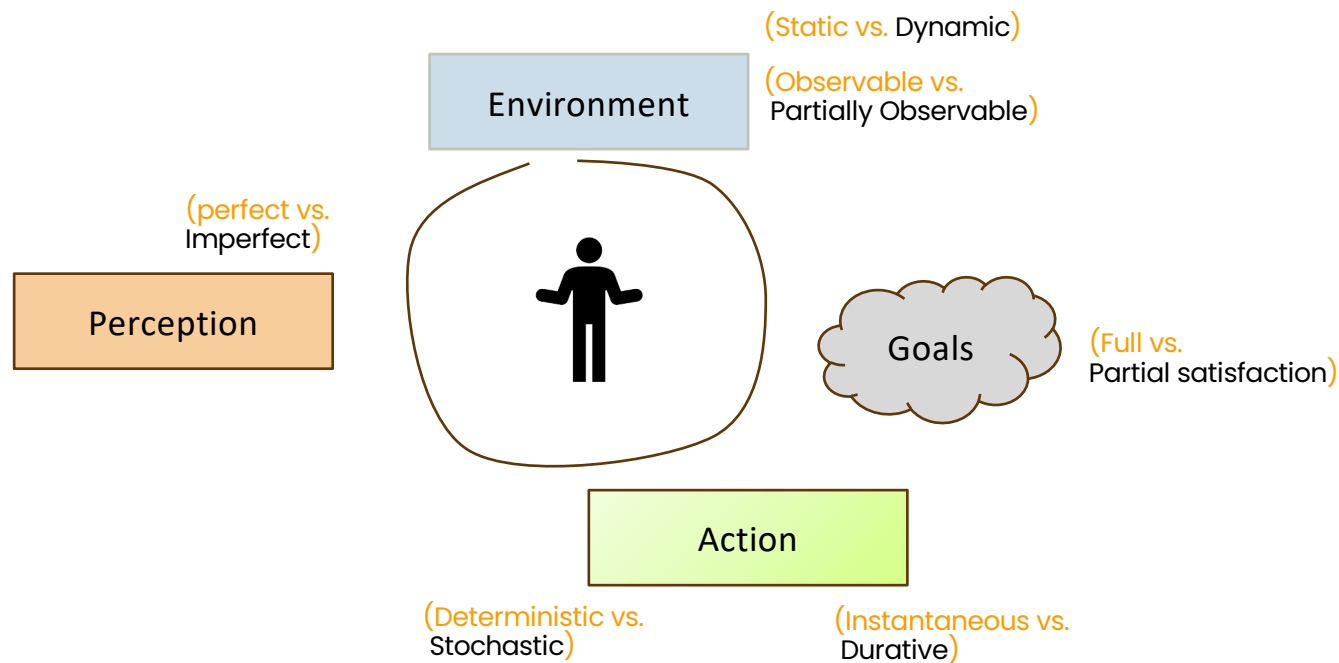
# Recap of Lecture 16

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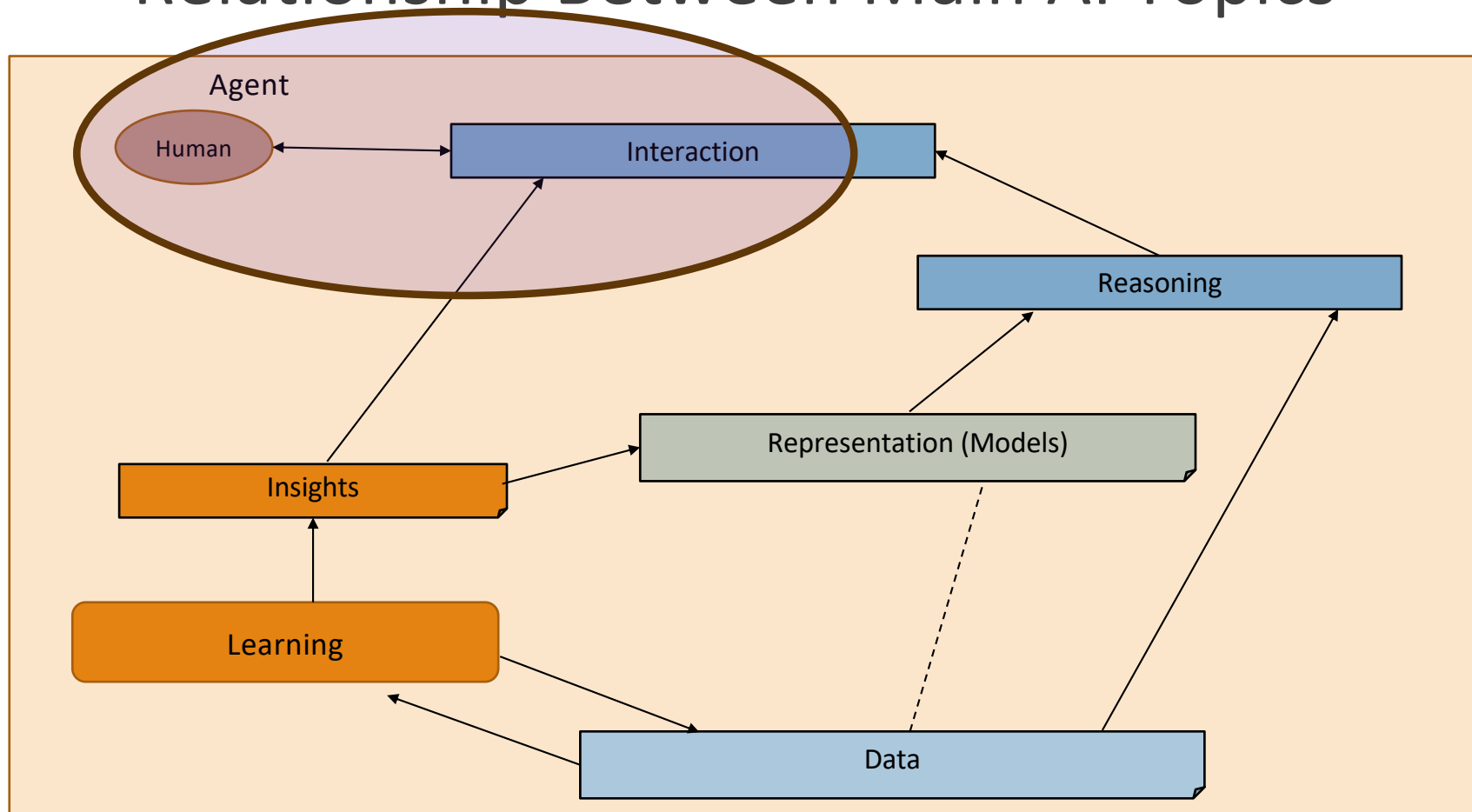
- Topic discussed
  - Trust Issues
    - Explainability
  - LIME tool

# Intelligent Agent Model

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# Relationship Between Main AI Topics



# Where We Are in the Course

## CSCE 580/ 581 – In This Course

- Week 1: Introduction, Aim: Chatbot / Intelligence Agent
- Weeks 2-3: Data: Formats, Representation and the Trust Problem
- Week 4-5: Search, Heuristics - Decision Making
- Week 6: Constraints, Optimization – Decision Making
- Week 7: Classical Machine Learning – Decision Making, Explanation
- Week 8: Machine Learning - Classification
- Week 9: Machine Learning - Classification – Trust Issues and Mitigation Methods
- Topic 10: Learning neural network, deep learning, Adversarial attacks
- Week 11: Large Language Models – Representation, Issues
- Topic 12: Markov Decision Processes, Hidden Markov models - Decision making
- Topic 13: Planning, Reinforcement Learning – Sequential decision making
- Week 14: AI for Real World: Tools, Emerging Standards and Laws; Safe AI/ Chatbots

# Main Section

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**Credit:** Retrieved from internet



# Rasa

- Rasa is an open source, scalable AI framework that can be used to build conversational agents.
- Rasa is used by many companies like American Express, BlueCross BlueShield, Dell, .....
- Chatbot terminology:
  - **Intent**: Intention of the user behind a message.
  - **Entity**: They are used to identify important parts of the message that affects the response chosen by the chatbot. Ex: Time, location.

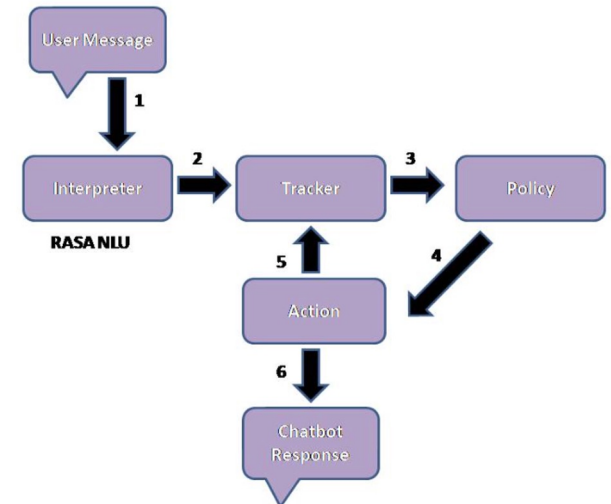
Message	Intent	Entities
When will the flight to ORD arrive at CAE?	Arrivals	ORD, CAE
Can I book an appointment with the dentist for tomorrow?	Booking	dentist, tomorrow

**Credit:**

1. <https://rasa.com/docs/rasa/>

# Rasa Workflow

- Rasa consists of two major components: Rasa NLU and Rasa Core.
  - Rasa Natural Language Understanding (NLU) takes user message as input and recognizes entities and intent and passes it to RASA core.
  - Rasa Core selects the appropriate response based on the the input passed by Rasa NLU and sends it back to the user.
- Rasa workflow:
  - User message is converted into a dictionary which consists of the message, intent, and entities extracted.
  - Tracker keeps a record of the conversation.
  - Current state of the tracker is sent to the policy which decides the next action that needs to be taken.
  - Chatbot's response depends on the action chosen.



**Credit:**

1. <https://rasa.com/docs/rasa/>
2. <https://www.analyticsvidhya.com/blog/2022/02/a-simple-guide-to-rasa-3-x/>

# Setting Up Virtual Environment (python env)

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1. If you do not have 'pip' on your system, download the script from: <https://bootstrap.pypa.io/get-pip.py>
2. Run 'python get-pip.py' on your terminal to install pip.
3. Run 'python3 -m pip install --user virtualenv' to install virtual environment package.
4. Run 'python3 -m venv env' to create a virtual environment, 'env'.
5. Run 'source env/bin/activate' to activate the virtual environment.
6. To leave the virtual environment, run 'deactivate'.

**Alternative:** use conda

# Setting Up Virtual Environment (conda env; recommended)

1. Install anaconda from <https://www.anaconda.com/download>.
2. To create a virtual environment, run the command 'conda create -name <env\_name> python==3.8'
3. To activate the environment, run 'conda activate <env\_name>'
4. To deactivate the environment, run 'conda deactivate'.

```
B:\ResearchPhD\Projects\Work\SafeChat\trustworthy-chatbot>conda create --name temp python==3.8
Collecting package metadata (current_repodata.json): done
Solving environment: failed with repodata from current_repodata.json, will retry with next repodata source.
Collecting package metadata (repodata.json): done
Solving environment: done

==> WARNING: A newer version of conda exists. <==
  current version: 23.3.1
  latest version: 23.9.0

Please update conda by running

    $ conda update -n base -c defaults conda

Or to minimize the number of packages updated during conda update use

    conda install conda=23.9.0

## Package Plan ##

environment location: C:\Users\klakk\.conda\envs\temp

added / updated specs:
  - python==3.8

The following NEW packages will be INSTALLED:

ca-certificates pkgs/main/win-64::ca-certificates-2023.08.22-haa95532_0
openssl          pkgs/main/win-64::openssl-1.1.1w-h2bbff1b_0
pip              pkgs/main/win-64::pip-23.3-py38haa095532_0
python           pkgs/main/win-64::python-3.8.0-hff0d562_2
setuptools       pkgs/main/win-64::setuptools-68.0.0-py38haa95532_0
sqlite           pkgs/main/win-64::sqlite-3.41.2-h2bbff1b_0
vc               pkgs/main/win-64::vc-14.2-h21ff451_1
vs2015_runtime   pkgs/main/win-64::vs2015_runtime-14.27.29016-h5e58377_2
wheel            pkgs/main/win-64::wheel-0.41.2-py38haa95532_0

Proceed ([y]/n)? y
```

# Build a Chatbot with Rasa

1. Install Rasa using the command, 'pip install rasa==3.1'
2. Run 'rasa init' to build a basic Rasa chatbot.
3. Run 'rasa shell' to talk to your chatbot.

```

Welcome to Rasa 🤖

To get started quickly, an initial project will be created.
If you need some help, check out the documentation at https://rasa.com/docs/rasa.
Now let's start!

? Please enter a path where the project will be created [default: current directory]
2023-10-23 18:19:48 INFO root - creating actions
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\actions\actions.py -> .\actions
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\actions\_init_.py -> .\actions
2023-10-23 18:19:48 INFO root - creating actions._pycache_
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\actions\_pycache_\_init_.pytho
n-38.pyc -> .\actions._pycache_
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\actions\_pycache_\_init_.pytho
n-38.pyc -> .\actions._pycache_
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\config.yml ->
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\credentials.yml -> .
2023-10-23 18:19:48 INFO root - creating data
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\data\nlu.yml -> .\data
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\data\rules.yml -> .\data
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\data\stories.yml -> .\data
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\domain.yml -> .
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\endpoints.yml -> .
2023-10-23 18:19:48 INFO root - creating tests
2023-10-23 18:19:48 INFO root - copying C:\Users\klakk\.conda\envs\dummy\lib\site-packages\rasa\cli\initial_project\tests\test_stories.yml -> .\tests
Created project directory at 'B:\ResearchPHD\Projects\WorkSafeChat\temp'.

Finished creating project structure
? Do you want to train an initial model? (y/n) (Y/n)

2023-10-23 18:20:06 INFO rasa.engine.training.broker - Starting to train component 'RulePolicy'.
2023-10-23 18:20:06 INFO rasa.engine.training.broker - Started training component 'RulePolicy'.
Processed actions: 51 [INFO: 6166, 201% / 8 examples] 2/2 [00:00:00.00, 1336.0bit/s, # action=0]
Processed trackers: 100% 2/2 [00:00:00.00, 673.0bit/s, # action=0]
Processed training time: 100% 5/5 [00:00:00.00, 1224.9bit/s]
2023-10-23 18:20:07 INFO rasa.engine.training.broker - Finished training component 'RulePolicy'.
2023-10-23 18:20:07 INFO rasa.engine.training.broker - Starting to train component 'TEDPolicy'.
2023-10-23 18:20:07 INFO rasa.engine.training.broker - Started training component 'TEDPolicy'.
Processed actions: 100% 120/120 [00:00:00.00, 574.0bit/s, # action=30]
Processed trackers: 100% 8,911/s, t_loss=0.58, loss_grad=42, acc=0.907]
2023-10-23 18:21:08 INFO rasa.engine.training.broker - Finished training component 'TEDPolicy'.
2023-10-23 18:21:08 INFO rasa.engine.training.broker - Starting to train component 'InspecitIntentionPolicy'.
2023-10-23 18:21:09 WARNING rasa.shared.utils.logging - The Inspecter Inten Policy is currently experimental, and might change or be removed in the future
2023-10-23 18:21:09 INFO rasa.engine.training.broker - Started training component 'InspecitIntentionPolicy'.
2023-10-23 18:21:09 INFO rasa.engine.training.broker - Started training component 'InspecitIntentionPolicy'.
Processed trackers: 100% 126/126 [00:00:00.00, 3426.6bit/s, # intent=12]
Epochs: 9,1bit/s, t_loss=0.123, losses=6.113, acc=1]
2023-10-23 18:21:22 INFO rasa.engine.training.broker - Finished training component 'InspecitIntentionPolicy'.
2023-10-23 18:21:22 INFO rasa.engine.training.broker - Starting to train component 'FlatTar.gz'.
? You want to speak to the trained assistant on the command line? Y or N
C:\Users\klakk\.conda\envs\dummy\lib\site-packages\sanic_ext\extension.py:39: DeprecationWarning: distutils Version Classes are deprecated. Use packaging.v
ersion instead.
  SANIC_VERSION = LooseVersion(sanic_version)
2023-10-23 18:21:38 INFO rasa - Connecting to channel 'cmdline' which was specified by the "--connector" argument. Any other channels will be ignored.
To connect to all given channels, omit the "--connector" argument.
2023-10-23 18:21:38 INFO rasa - Starting http server on http://0.0.0.0:5005
2023-10-23 18:21:35 INFO rasa.core.processor - Loading model file(20231023-182036-dennis-flat.tar.gz)
2023-10-23 18:21:35 INFO rasa.core.processor - The Inspecter Inten Policy is currently experimental, and might change or be removed in the future
? Please share your feedback on it in the forum (https://forum.rasa.com) to help us make this feature ready for production.
Bot loaded type: python press enter (use '/stop' to exit):
You: Hi, how are you?
I am a bot, powered by Rasa.
Your input: How are you?
I am a bot, powered by Rasa.
Your input: Hi
Hey! How are you?
Your input: Not fine!
Here is something to cheer you up:
Jesse: https://i.imgur.com/2t8sf.jpg
Did that help you?
Your input: No
Bye
Your input: ...

```

# What is SafeChat?

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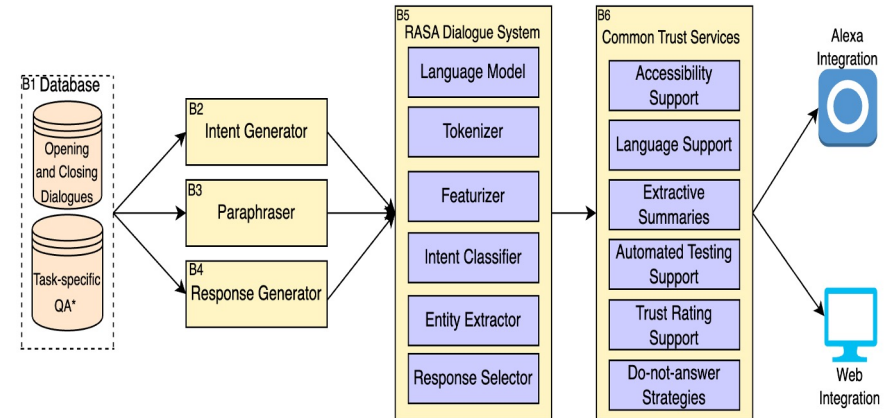
- SafeChat architecture was introduced in [1]. It is a Rasa-based framework that can be used to build safe and trustworthy chatbots.
- The uniqueness of SafeChat is:
  - A safe design where the responses can be traced back to their original source (e.g., official FAQs).
  - A do-not-answer strategy that can deflect certain user questions that are not supposed to be answered.
  - A low-programming design pattern based on the open-source Rasa platform to generate chatbots quickly for any region.
  - A quick domain-independent chatbot framework with CSV-based Q/A support and automatic intent generator with support for backend integration and testing.

## References:

1. Muppasani, B., Pallagani, V., Lakkaraju, K., Lei, S., Srivastava, B., Robertson, B., ... & Narayanan, V. (2022). On Safe and Usable Chatbots for Promoting Voter Participation. *arXiv preprint arXiv:2212.11219*.

# SafeChat Architecture (1/2)

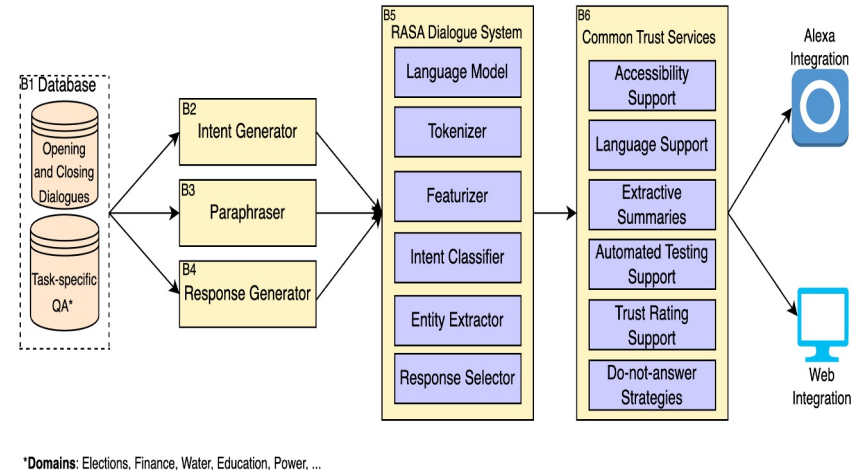
- **Database (B1):** The database is the source from which we extract the training data to train the chatbot. We ensure that the source is reliable and trustworthy. Task-specific QA refers to the data source pertaining to the chosen domain. The opening and closing dialogues are usually generic (like greeting and saying bye).
- **Intent Generator (B2):** Intent Generator helps in tagging existing questions to an intent, which can later be utilized to map any new incoming user utterance to an available intent to provide desired answers.
- **Paraphraser (B3):** A paraphraser can be used to augment the training data by paraphrasing the questions given in an official FAQ document.



\*Domains: Elections, Finance, Water, Education, Power, ...

# SafeChat Architecture (2/2)

- **Response Generator (B4):** A response is usually text but can also include multi-modal content like images and audio. The safe chatbot architecture reuses the response generation module available in the RASA Dialogue System.
- **RASA Dialogue System (B5):** We use the RASA chatbot framework to build the chatbot. The dialogue system has an NLU pipeline with different components for understanding human conversation and responding appropriately.
- **Common Services (B6):** The common services are optional, and the user has the flexibility of choosing the services they need. Some of the accessibility options are font settings and Text-to-Speech.
- **System Integration:** Our framework allows easier web integration and integration with Alexa.





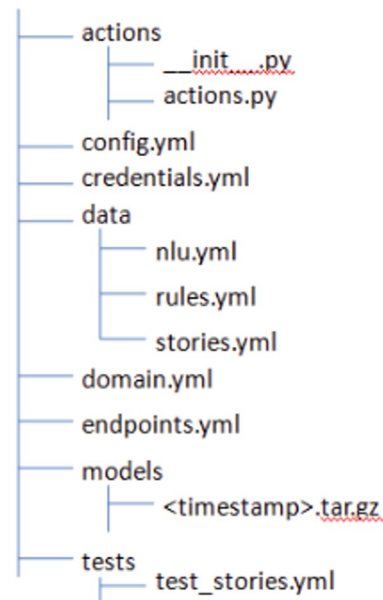
# Building a Chatbot using SafeChat

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1. Run 'git clone <https://github.com/ai4society/trustworthy-chatbot.git>' to clone our SafeChat repository.
2. Go to the project directory and run 'pip install -r requirements.txt' to install all the required packages.
3. Run 'code/configure\_rasa.py', 'code/extract\_intent.py' and 'code/paraphraser.py' files in the same order to create your chatbot.

# Chatbot File Structure

- `config.yml`: It has pipeline, policies, and other NLU components.
- `'/data'` consists of:
  - `nlu.yml`: It contains intents and examples for each intent with entities.
  - `rules.yml`: Defines a fixed conversation path that chatbot follows.
  - `stories.yml`: It contains conversations paths the chatbot needs to take in order to respond to the user messages appropriately.
- `domain.yml`: This file acts as an index for the chatbot. It contains intents, entities, slots, responses, forms, and actions.
- `'/models'` contain the trained chatbot model that can be used to talk to the chatbot.



**Credit:**

1. <https://rasa.com/docs/rasa/>
2. <https://www.analyticsvidhya.com/blog/2022/02/a-simple-guide-to-rasa-3-x/>

# Running your chatbot

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1. Go to the 'Chatbot' directory that is generated and to train the chatbot, run 'rasa train'.
2. To talk to the trained chatbot, run 'rasa shell'. Also, run 'rasa run actions' in another instance of the terminal.

# Build your own chatbot with SafeChat

1	Question	Answer
2	It is past the voter registration deadline and I haven't updated my info.	If you
3	What offices, candidates and questions are on my ballot?	The offices, candidates and questions on a particular ballot will vary depending on the county and districts in which you reside.
4	How and where can I vote early in person?	Visit an early voting center in your county during the early voting period and vote in person like you would at your polling place on election day.
5	Who can vote absentee?	State law allows voters with qualifying reasons to vote absentee by mail:
6	How can I vote absentee?	Step 1: Get your application
7	It's almost Election Day and I still have my absentee ballot.	You can vote your absentee ballot and return it to your county elections office by mail or personal delivery by 7:00 p.m. on election day (or an
8	I'm not voting early. Where do I vote on Election Day?	At the polling place in your precinct.
9	What hours are polling places open on Election Day?	Polling places will be open 7:00 a.m. to 7:00 p.m. As long as you are in line by 7:00 p.m., you will be allowed to vote.
10	What do I take with me to vote?	Your Photo ID.
11	What if I don't have one of these Photo IDs?	Make your voting experience as fast and easy as possible by getting a free Photo ID before voting.

1. Create a new 'Chat.csv' file in the 'data/' directory with your desired FAQs. The CSV should have a column called 'Question' with all the queries and another column called 'Answer' with the corresponding answers.
2. Run 'code/configure\_rasa.py', 'code/extract\_intent.py' and 'code/paraphraser.py' files in the same order to create your chatbot.
3. Go to the generated 'Chatbot/' directory. Run 'rasa train' to train the chatbot and 'rasa shell' to interact with your chatbot. Also, run 'rasa run actions' in another instance of the terminal.

## Working Screenshots: Running the Chatbot

```

D:\BMS\ResearchPhD\Projects\Work\SafeChat\trustworthy-chatbot\Chatbot\ rasa run actions
C:\Users\klakk\conda\envs\dummy\lib\site-packages\rasa\core\tracker_store.py:838: MovedIn20Warning: Deprecated API features detected! These features() are not compatible with SQLAlchemy 2.0. To prevent incompatible upgrades prior to updating applications, ensure requirements files are pinned to "sqlalchemy<2.0". Set environment variable SQLALCHEMY_WARN_20=1 to show all deprecation warnings. Set environment variable SQLALCHEMY_SILENCE_UBER_WARNING=1 to silence this message. (Background on SQLAlchemy 2.0 at: https://sqlalche.me/e/b809)
Base: DeclarativeMeta = declarative_base()
C:\Users\klakk\conda\envs\dummy\lib\site-packages\rasa\shared\utils\validation.py:131: DeprecationWarning: pkg_resources is deprecated as an API. I see https://setuptools.pypa.io/en/latest/pkg_resources.html
import pkg_resources
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('google')'.
Implementing implicit namespace packages (as specified in PEP 420) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.pypa.io/en/latest/references/keywords.html#keyword-namespace-packages
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('mpl_toolkits')'.
Implementing implicit namespace packages (as specified in PEP 420) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.pypa.io/en/latest/references/keywords.html#keyword-namespace-packages
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('google')'.
Implementing implicit namespace packages (as specified in PEP 420) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.pypa.io/en/latest/references/keywords.html#keyword-namespace-packages
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('ruamel')'.
Implementing implicit namespace packages (as specified in PEP 420) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.pypa.io/en/latest/references/keywords.html#keyword-namespace-packages
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\sanic_cors\extension.py:39: DeprecationWarning: distutils Version classes are deprecated. Use packaging.version instead.
SANIC_VERSION = LooseVersion(sanic_version)

2023-10-24 11:18:16 INFO rasa_sdk.endpoint - Starting action endpoint server...
2023-10-24 11:18:16 INFO rasa_sdk.executor - Registered function for 'action_save_conversation'.
2023-10-24 11:18:16 INFO rasa_sdk.executor - Registered function for 'action_session_id'.
2023-10-24 11:18:16 INFO rasa_sdk.endpoint - Action endpoint is up and running on http://0.0.0.0:5855

```

```

dummy) B:\Research\PhD\Projects\Work\SafeChat\trustworthy-chatbot(ChatbotTraxx shell
C:\Users\klakk\conda\envs\dummy\lib\site-packages\rasa\core\tracker_store.py:838: MovedIn20Warning: Deprecated API features detected: These features are not compatible with SQLAlchemy 2.0. To prevent incoming
stable upgrades prior to updating applications, ensure requirements files are pinned to "sqlalchemy<2.0". Set environment variable SQLAlchemy_WARN_20=1 to show all deprecation warnings. Set environment vari
ble SQLAlchemy_SILENCE_USER_WARNINGS=1 to silence this message. (Background on SQLAlchemy 2.0 at: https://sqlalche.me/e/20)
Base: DeclarativeMeta = declarative_base()
C:\Users\klakk\conda\envs\dummy\lib\site-packages\rasa\shared\utils\validation.py:131: DeprecationWarning: pkg_resources is deprecated as an API. See https://setuptools.py
ia.io/en/latest/pkg_resources.html
import pkg_resources
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('google')'.
Implementing implicit namespace packages (as specified in PEP 428) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.py
ia.io/en/latest/references/keywords.html#keyword-namespace-package
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('wpl_toolkits')'.
Implementing implicit namespace packages (as specified in PEP 428) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.py
ia.io/en/latest/references/keywords.html#keyword-namespace-package
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('google')'.
Implementing implicit namespace packages (as specified in PEP 428) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.py
ia.io/en/latest/references/keywords.html#keyword-namespace-package
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\pkg_resources\__init__.py:2871: DeprecationWarning: Deprecated call to 'pkg_resources.declare_namespace('ruamel')'.
Implementing implicit namespace packages (as specified in PEP 428) is preferred to 'pkg_resources.declare_namespace'. See https://setuptools.py
ia.io/en/latest/references/keywords.html#keyword-namespace-package
declare_namespace(pkg)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\sklearn\multiclass.py:14: DeprecationWarning: Please use 'spmatrix' from the 'scipy.sparse' namespace, the 'scipy.sparse.base' namespace is deprecated.
from scipy.sparse.base import spmatrix
C:\Users\klakk\conda\envs\dummy\lib\site-packages\future\standard_library__init__.py:65: DeprecationWarning: the imp module is deprecated in favour of importlib; see the module's documentation for alternati
ve uses
import imp
C:\Users\klakk\conda\envs\dummy\lib\site-packages\matplotlib__init__.py:169: DeprecationWarning: distutils Version classes are deprecated. Use packaging.version instead.
if LooseVersion(module.__version__) < minver:
C:\Users\klakk\conda\envs\dummy\lib\site-packages\setuptools\distutils\version.py:345: DeprecationWarning: distutils Version classes are deprecated. Use packaging.version instead.
other = LooseVersion(other)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\tensorflow_addons\utils\ensure_tf_install.py:47: DeprecationWarning: distutils Version classes are deprecated. Use packaging.version instead.
min_version = LooseVersion(INCLUSIVE_MIN_TF_VERSION)
C:\Users\klakk\conda\envs\dummy\lib\site-packages\sanic_core\extension.py:39: DeprecationWarning: distutils Version classes are deprecated. Use packaging.version instead.
SANIC_VERSION = LooseVersion(sanic_version)
2023-10-24 11:18:27 INFO root - Connecting to channel 'cmdline' which was specified by the '-connector' argument. Any other channels will be ignored. To connect to all given channels, omit the '--connect
to' argument.
2023-10-24 11:18:27 INFO root - Starting Rasa server on http://0.0.0.0:5005
2023-10-24 11:18:28 INFO rasa_core.processor - Loading model models/20231024-111523-pizzicato-buyer.tar.gz...
2023-10-24 11:18:28 WARNING rasa.shared.utils.common - The Unacceptable Intent Policy is currently experimental and might change or be removed in the future ^ Please share your feedback on it in the forum (h
ttps://forum.rasa.com) to help us make this feature ready for production.
2023-10-24 11:19:23 INFO root - Rasa server is up and running.
not loaded. Type a message and press enter (use '/stop' to exit):
our input -> hi
hey! How are you?
```

# Working Screenshots: Talking to the Chatbot

---

```
2023-10-24 11:30:29 INFO      root - Rasa server is up and running.  
Bot loaded. Type a message and press enter (use '/stop' to exit):  
Your input -> What is the capital of South Carolina?  
The capital of South Carolina is Columbia.  
Your input -> What is the capital of Arizona?  
The capital of Arizona is Phoenix.  
Your input -> What is the capital of North Carolina?  
The capital of North Carolina is Raleigh.
```

# Survey Link

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Please fill the survey using the following link to help us improve our SafeChat architecture.



# Course Project

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# Project Discussion: What Problem Fascinates You ?

---

- Data
  - Water
  - Finance
  - ...
- Analytics
  - Search, Optimization, Learning, Planning, ...
- Application
  - Building chatbot
- Users
  - Diverse demographics
  - Diverse abilities
  - Multiple human languages

## Project execution in sprints

- Sprint 1: (Sep 12 – Oct 5)
  - **Solving**: Choose a decision problem, identify data, work on solution methods
  - **Human interaction**: Develop a basic chatbot (no AI), no problem focus
- Sprint 2: (Oct 10 – Nov 9)
  - **Solving**: Evaluate your solution on problem
  - **Human interaction**: Integrated your choice of chatbot (rule-based or learning-based) and methods
- Sprint 3: (Nov 14 – 30)
  - **Evaluation**: Comparison of your solver chatbot with an LLM-based alternative, like ChatGPT

# Project Discussion: Dates and Deliverables

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## Project execution in sprints

- Sprint 1: (Sep 12 – Oct 5)
  - **Solving**: Choose a decision problem, identify data, work on solution methods
  - **Human interaction**: Develop a basic chatbot (no AI), no problem focus
- Sprint 2: (Oct 10 – Nov 9)
  - **Solving**: Evaluate your solution on problem
  - **Human interaction**: Integrated your choice of chatbot (rule-based or learning-based) and methods
- Sprint 3: (Nov 14 – 30)
  - **Evaluation**: Comparison of your solver chatbot with an LLM-based alternative, like ChatGPT

- Oct 12, 2023
  - Project checkpoint
  - In-class presentation
- Nov 30, 2023
  - Project report due
- Dec 5 / 7, 2023
  - In-class presentation

# Skeleton: A Basic Chatbot

- Run in an infinite loop until the user wants to quit
- Handle any user response
  - User can quit by typing “Quit” or “quit” or just “q”
  - User can enter any other text and the program has to handle it. The program should write back what the user entered and say – “I do not know this information”.
- Handle known user query types // Depends on your project
  - “Tell me about N-queens”, “What is N ?”
  - “Solve for N=4?”
  - “Why is this a solution? ”
- Handle chitchat // Support at least 5, extensible from a file
  - “Hi” => “Hello”
  - ...
- *Store session details in a file*

## Illustrative Project

1. **Title:** Solve and explain solving of n-queens puzzle
2. **Key idea:** Show students how a course project will look like
3. **Who will care when done:** students of the course, prospective AI students and teachers
4. **Data need:** n: the size of game; interaction
5. **Methods:** search
6. **Evaluation:** correctness of solution, quality of explanation, appropriateness of chat
7. **Users:** with and without AI background; with and without chess background
8. **Trust issue:** user may not believe in the solution, may find interaction offensive (why queens, not kings? ...)

# Project Discussion: Illustration

1. Create a private Github repository called “CSCE58x-Fall2023-<studentname>-Repo”. Share with Instructor (biplav-s) and TA (kausik-l)
2. Create Google folder called “CSCE58x-Fall2023-<studentname>-SharedInfo”. Share with Instructor ([prof.biplav@gmail.com](mailto:prof.biplav@gmail.com)) and TA ([lakkarajukausk90@gmail.com](mailto:lakkarajukausk90@gmail.com))
3. Create a Google doc in your Google repo called “Project Plan” and have the following by next class (Sep 5, 2023)

1. **Title:** Solve and explain solving of n-queens puzzle
2. **Key idea:** Show students how a course project will look like
3. **Who will care when done:** students of the course, prospective AI students and teachers
4. **Data need:** n: the size of game; interaction
5. **Methods:** search
6. **Evaluation:** correctness of solution, quality of explanation, appropriateness of chat
7. **Users:** with and without AI background; with and without chess background
8. **Trust issue:** user may not believe in the solution, may find interaction offensive (why queens, not kings? ...)

# Project Illustration: N-Queens

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- Sprint 1: (Sep 12 – Oct 5)
  - **Solving**: Choose a decision problem, identify data, work on solution methods
    - Method 1: Random solution
    - Method 2: Search – BFS
    - Method 3: Search - ...
  - **Human interaction**: Develop a basic chatbot (no AI) as outlined
- Deliverable
  - Code structure in Github
    - ./data
    - ./code
    - ./docs
    - ./test
  - Presentation: Make sprint presentation on Oct 12, 2023

# Reference: Project Rubric

- **Project results – 60%**
  - Working system ? – 30%
  - Evaluation with results superior to baseline? – 20%
  - Considered related work? – 10%
- **Project efforts – 40%**
  - Project report – 20%
  - Project presentation (updates, final) – 20%
- **Bonus**
  - Challenge level of problem – 10%
  - Instructor discretion – 10%
- **Penalty**
  - Lack of timeliness as per announced policy (right) - up to 30%

## Milestones and Penalties

- Oct 12, 2023
  - Project checkpoint
  - In-class presentation
  - **Penalty: presentation not ready by Oct 10, 2023 [-10%]**
- Nov 30, 2023
  - Project report due
  - **Project report not ready by date [-10%]**
- Dec 5 / 7, 2023
  - In-class presentation
  - **Project presentations not ready by Dec 4, 2023 [-10%]**

# Lecture 17: Summary

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- We talked about
  - Building Chatbots
  - Rasa
  - SafeChat Framework

# Concluding Section

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# About Next Lecture – Lecture 18

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# Lecture 18: Explanation, Machine Learning – Unsupervised

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- Recap: Trusted AI/ Explanations
- Unsupervised ML/ Clustering