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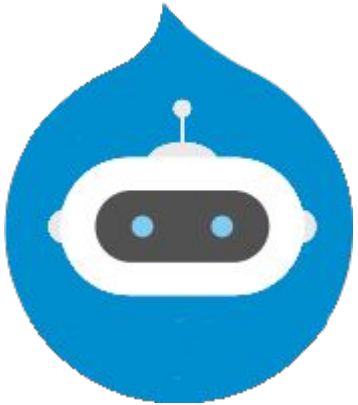
Practical Applications of AI Chatbots in Drupal



Rick Torzynski

Senior Drupal Developer, ECS

Sponsored by Esteemed

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About Me

I've been a Drupal Developer for 13+ years, currently working on United States government agency Drupal websites, healthcare Drupal websites, machine learning applications, and software engineering.

ECS

Senior Drupal Developer

TEKsystems Own change

Drupal Developer at Florida Blue

NLP LOGIX AI REALIZED

Senior Software Engineer

Drupal Username: mandolinrick

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Our Agenda

- History of Chatbots
- Why Use a Chatbot?
- Chatbot Frameworks
- Machine Learning/Deep Learning
- Chatbot Basics
- How Chatbots Learn
- Demo
- Looking to the Future
- Questions?

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Robby the Robot

The Forbidden Planet (1956)

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B9 Space Robot

Lost in Space (1965-1968)

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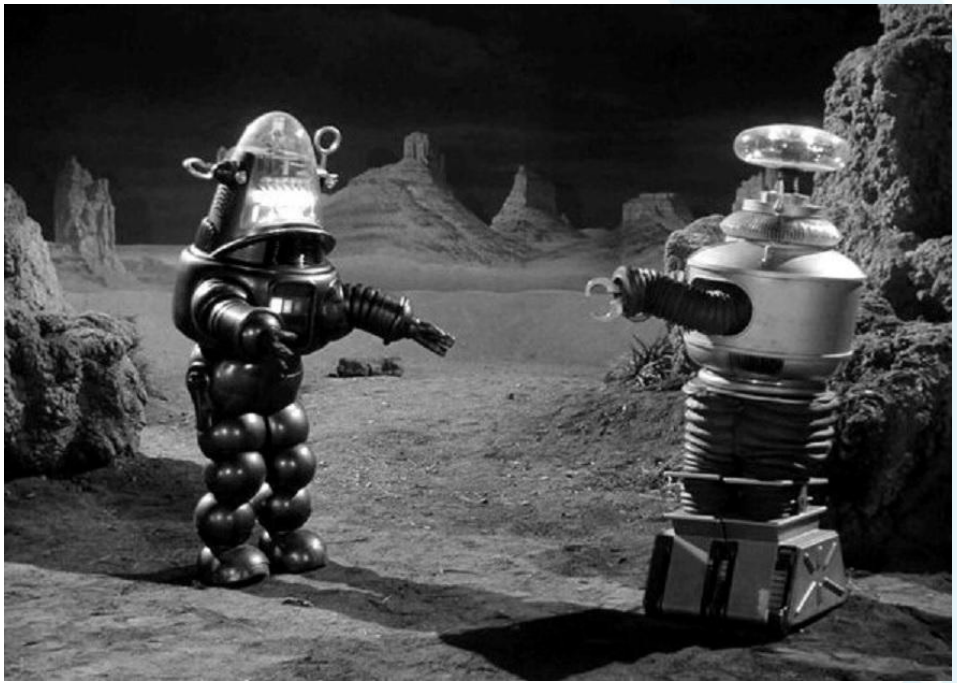
Robby versus B9 Space Robot

Lost in Space (1968)



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Star Trek Computers

Star Trek (1966-1969)

Computer

M-5 Multitronic System

Nomad

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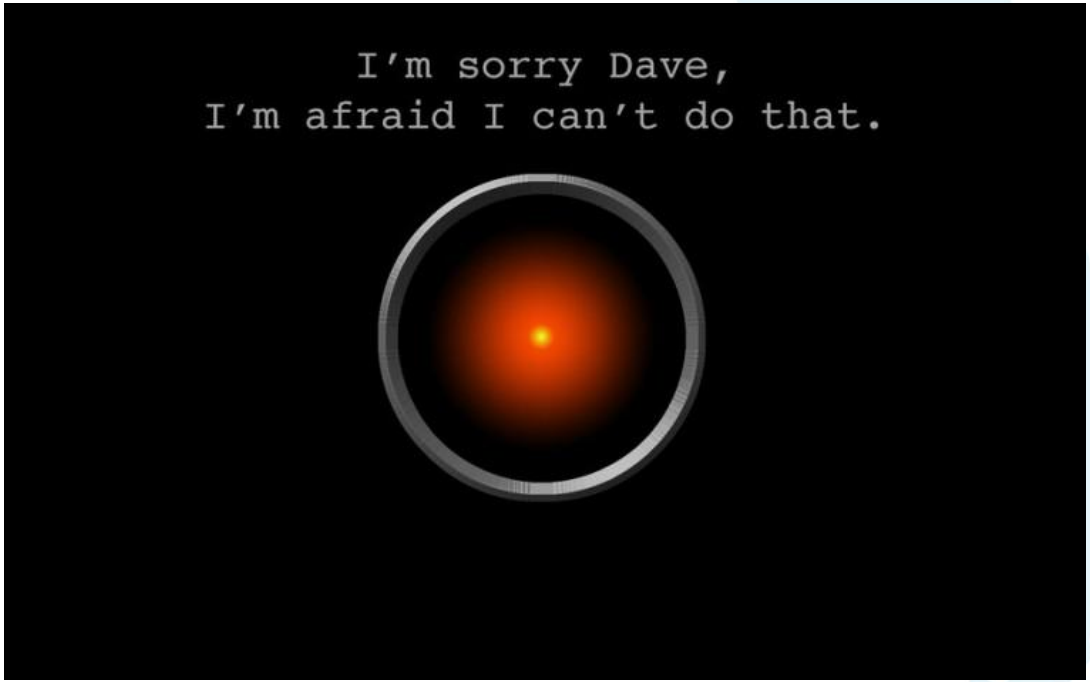
Hal 9000

2001: A Space Odyssey (1968)



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Data

Star Trek: The Next Generation (1987-1994)

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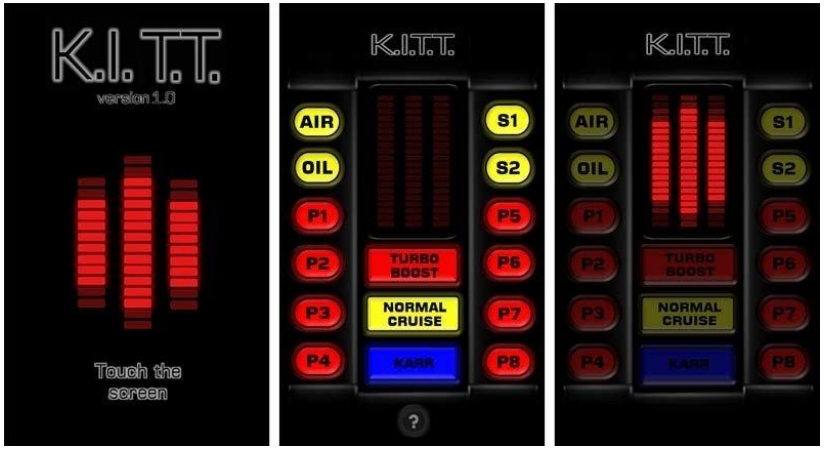
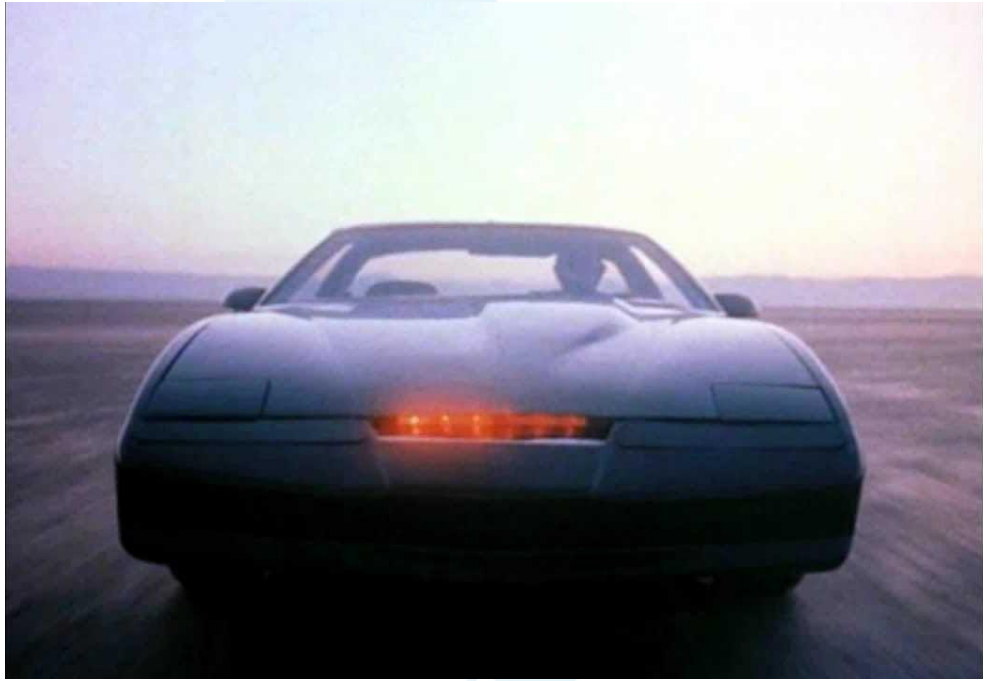
K.I.T.T.

Knight Rider (1982-1986)





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Joshua (WOPR)

Wargames (1983)

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History of Chatbots

1964

Operational

Symbolic rule-based

Eliza (1964)

Eliza Bot
Eliza Bot Github

1990

Statistical

Bayesian
Markov Chains
Neural Networks

2010

Neural Methods

GPU use
RNN
LSTM
Seq2Seq
ML Happening!

Apple Siri (2011)
Google Now (2012)
MS Cortana (2013)
Amazon Alexa (2014)
Google Assistant (2016)

2017

Transformers

BERT: 340M (OS)
GPT-3: 175B
GPT-J-6B: 6B (OS)
Switch Transformer: 1.7T (OS)
GPT-4: 100T

GPT-J-6B Demo

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Why Use a Chatbot?

1. 24/7 Availability
2. Generate more conversations
3. Can handle multiple customers
4. Not subject to mood swings
5. Collect and analyze data
6. Personalize Conversations
7. Multilingual
8. Automate processes
9. Can be deployed anywhere

Chatbot Providers and Frameworks

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Why Choose Rasa?

Pros

1. Open source
2. Uses YAML for configuration and content files
3. Well documented RESTful API
4. Active development
5. Excellent support
   a. Documentation
   b. Active YouTube channel
   c. Office hours
6. Cutting edge models and pipelines
   a. Graph based development pipeline in 3.0 to greatly reduce training time
7. Customizable

Cons

1. Written in Python
   a. Model development - Python
   b. Model inference - JavaScript
2. Requires machine learning education/development
   a. Needed for meaningful development
3. Complex
   a. Needed for extreme customization
4. Requires creation of knowledge base/training stories
   a. Single domain chatbot
   b. AnswerThePublic.com
      i. Excellent source material

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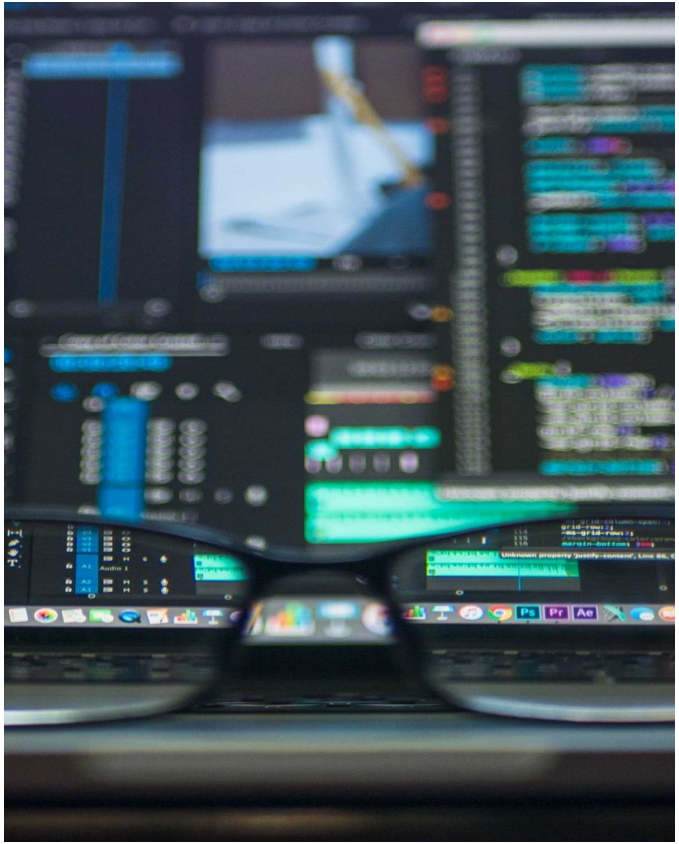

Machine Learning

"Machine learning focuses on applications that learn from experience and improve their decision-making or predictive accuracy over time." - IBM

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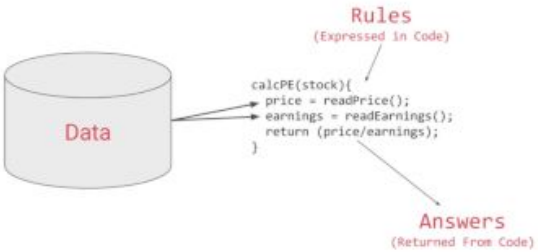
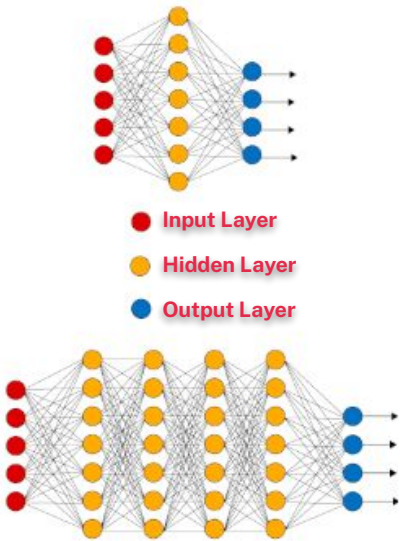
Machine Learning



- **Types of Machine Learning**
  - **Supervised Learning - for a set of data, the outcome is known (linear regression, classification)**
  - **Unsupervised Learning - outcome unknown, but interested in how data clusters together into groups (PCA, Recommender)**
- **Programming Paradigm**
  - **Traditional Programming**
    - **Data/Input + Rules = Answers**
  - **Machine Learning**
    - **Data/Input + Answers = Rules**

Diagram: Moroney, L. (2021). AI and Machine Learning for Coders: A Programmer's Guide to Artificial Intelligence. O'Reilly.

Deep Learning



"A subfield of machine learning concerned with algorithms inspired by the structure and function of the brain called artificial neural networks."

- Input Layer - Images, text, audio, video, numbers, etc. Must be quantifiable.
- Hidden Layers - Filters for feature extraction
- Output Layer - Classification, prediction
- Activation function - takes in the output signal from the previous cell and converts it into some form that can be taken as input to the next cell.
  - Sigmoid, ReLU and Softmax

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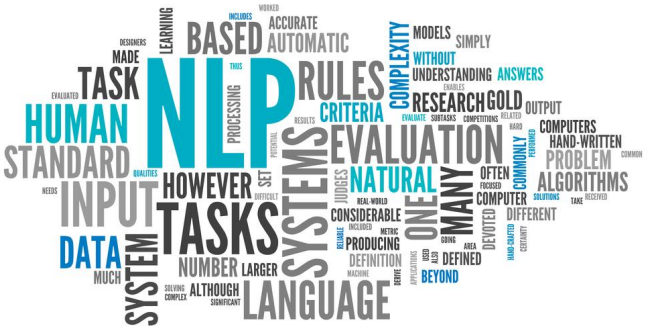
Deep Learning

Components of NLP



- **Natural Language Processing (NLP)**
  - NLP is a subset of AI and is what happens when computers read language. NLP turns language into structured data.
  - Parsing, tokenizing, stemming, text summarization, text categorization, wordclouds etc.
- **Natural Language Understanding (NLU)**
  - NLU is a subset of NLP and is what happens when computers understands language.
  - Sentiment detection, topic classification, entity detection are examples
- **Natural Language Generation (NLG)**
  - NLG is what happens when computers writes language. NLP turns structured data into language.
  - Examples include text generation, story generation, music generation and chatbot responses.

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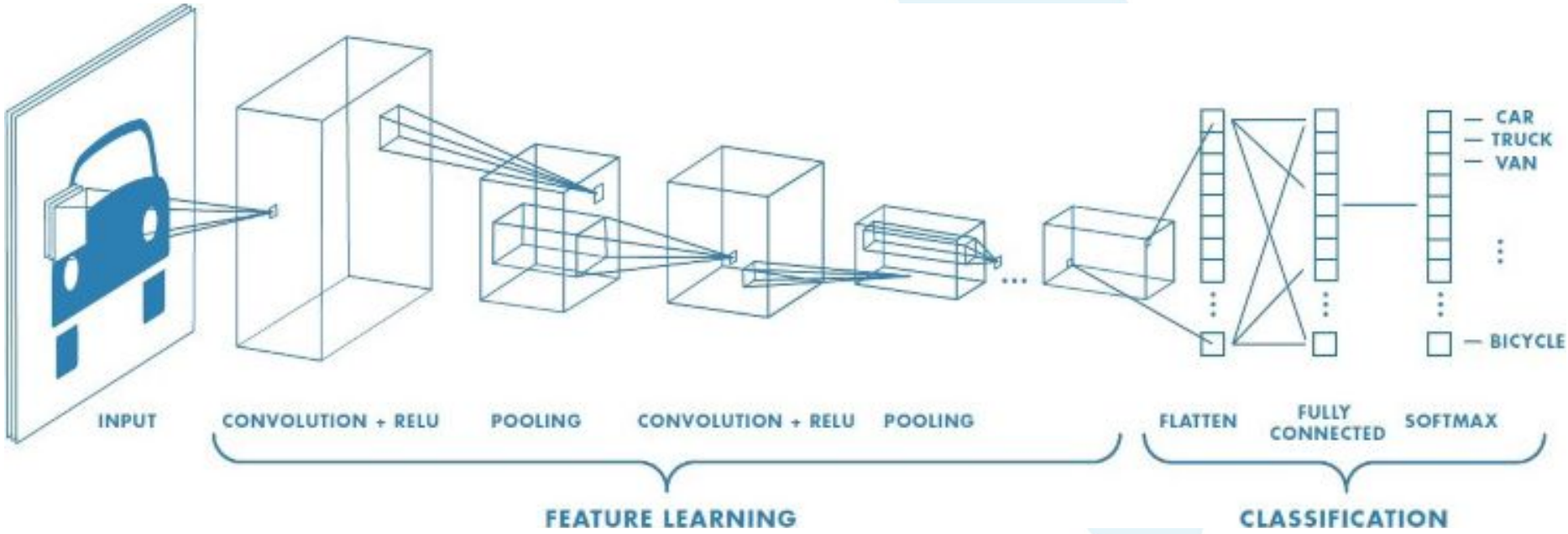
Deep Learning

Convolutional Neural Network



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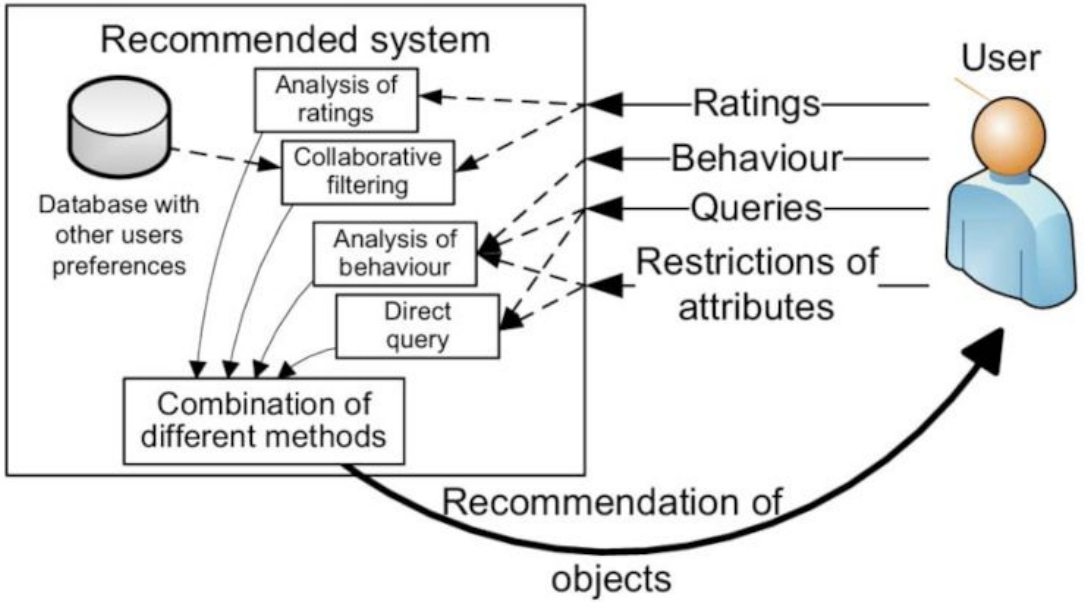
Deep Learning

Recommendation Engine



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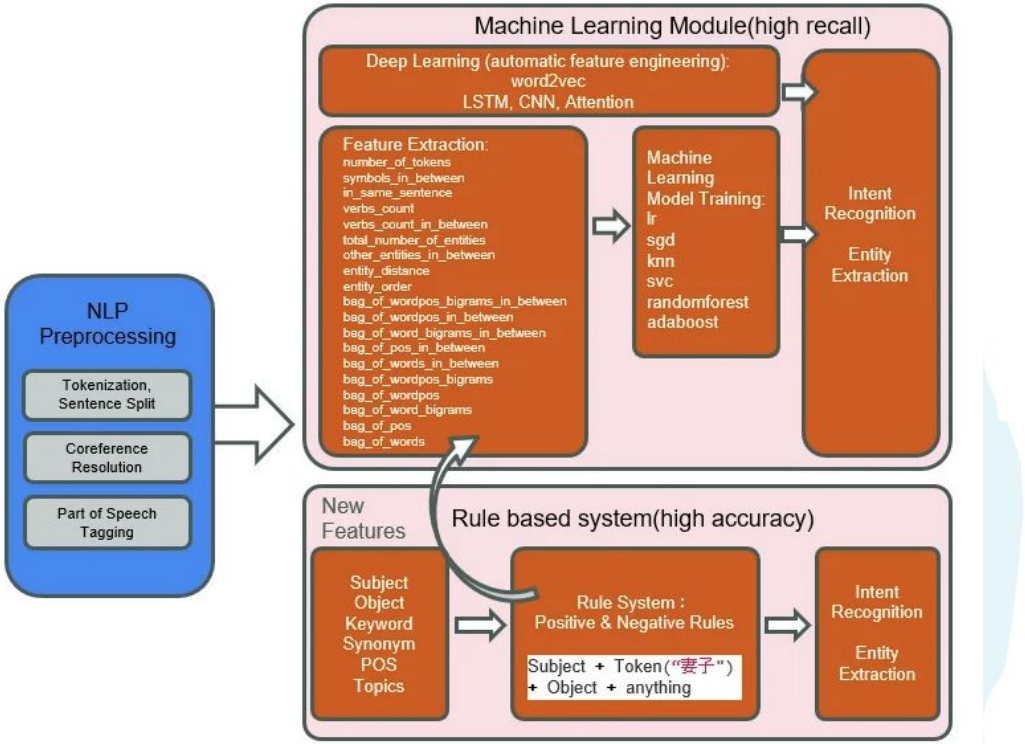
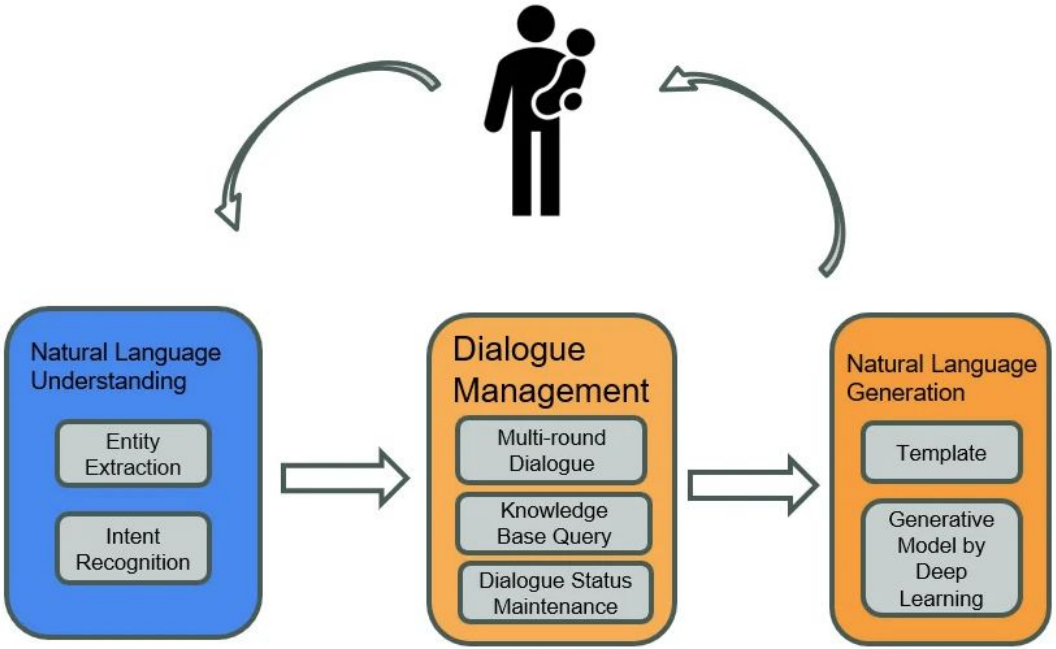
Deep Learning

Natural Language Understanding (NLU)



Deep Learning

Dialogue Manager (DM)



User: Kid is sick, what should I do?

NLU Intent Recognition : Sickness
NLU Entity Extraction : Child
DM : No Age, No Symptom, No Gender
NLG

Bot: How old is your child? Boy or girl?
User: 6 months. Boy.

NLU Entity Extraction : 0.5 years old; Male
DM : No Symptom
NLG

Bot: What symptom does he have?
User: He is having a fever.

NLU Entity Extraction : fever
DM : Query on Knowledge Base， Define and Finish task
NLG

Bot: Please call Dr. Cai at 13333333333

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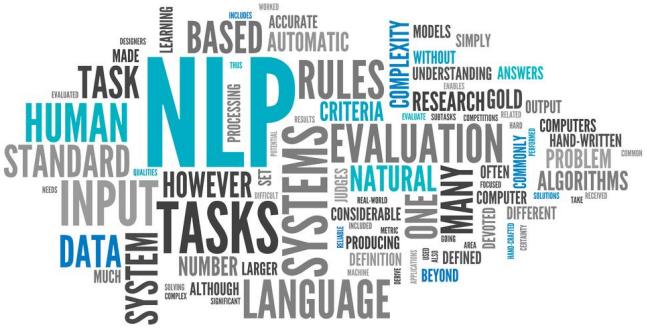

How Chatbots Work

Intent Recognition/Classification

- What the user wants to do
- Raw text in, machine readable information out
- Can also be rule-based or regex
- Neural Models such as transformer models (BERT, DIET)

Dialogue Management

- Dialogue Policy - what should the chatbot do next based on the conversation
- Uses some rules
- Transformer Embedding Dialogue (TED) Policy - selects which action to take next
- Requires training examples

Response and/or Action Taken

- Action can be utterance
- Action could be an automated process or call to another API
- Another step in the conversation

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Components of Intent Based Chatbot

- **Intents**
  - What the user wants to do
- **Entities**
  - Important pieces of information
- **Stories**
  - Ways the conservation can go
  - Training data
- **Actions**
  - What action the chatbot can take
- **Slots**
  - Key, value pair acts as memory of the chatbot

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Installing and Configuring Rasa

```
# For Ubuntu
$ sudo apt update
# Install python3.8 (max)
$ sudo apt install python3.8 python3-pip
# Create virtual environment
$ python3 -m venv ./venv
# Activate venv environment
$ source ./venv/bin/activate
# Make sure latest version of pip3
(venv)$ pip3 install -U pip
# Install Rasa
(venv)$ pip3 install rasa
# Create starter chatbot
(venv)$ rasa init
(venv)$ rasa train
(venv)$ rasa shell
(venv)$ rasa run --enable-api --model
./models --endpoints ./endpoints.yml
--cors "*"
```

```
…/Rasa/chatbot
        …/actions
          …/actions.py
          …/__init.py
        …/config.yml
        …/credentials.yml
        …/data
          …/nlu.yml
          …/rules.yml
          …/stories.yml
        …/domain.yml
        …/endpoints.yml
        …/tests
          …/test_stories.yml
```

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Installing and Creating Custom Component Module

Create AI Chatbot Rasa Component

- Install Component Module
- Enable Component Module
- Create custom ai_chatbot module
- Create Page content type
- Add AI Chatbot Comp Rasa block to body section.

File Structure

```
…/web/modules/custom/ai_chatbot

…/ai_chatbot
  …/ai_chatbot.info.yml
  …/components
    …/comp_rasa
      …/comp_rasa.component.yml
      …/index.html
      …/css
        …/Chatroom.css
      …/js
        …/Chatroom.js
        …/rasa.js
```

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Demo

Configure Rasa

- Create data/nlu.yml
- Create data/stories.yml
- Create domain.yml
- Train Model $ rasa train
- Start up rasa server:
- rasa run --enable-api --model ./models --endpoints ./endpoints.yml --cors "*"

Guidelines for First Chatbot

- ~10 Intents to start with
- Simple Intents
- Use expert knowledge
- Use AnswerThePublic.com to get list of most popular domain questions

Create Custom Component Module

- Create ai_chatbot_info.yml
- Create comp_rasa.component.yml
- Create index.html
- Create rasa.js
- In admin Structure→Block layout
- In Content Region → Place Block
- Select AI Chatbot Comp Rasa block
- Uncheck Display Title
- In Visibility → Pages restrict block to content url
- Save Block

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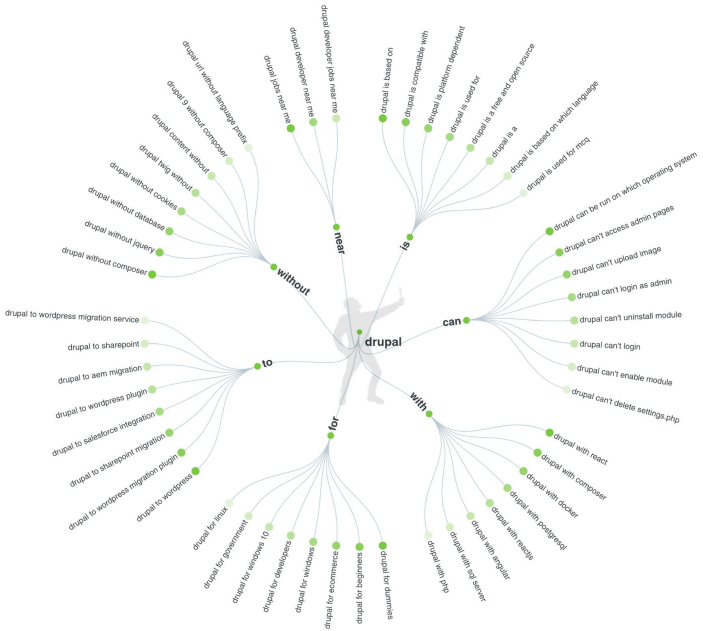

[Answer the Public Results]

Who
1. Drupal who's online
2. Drupal who uses
3. who owns drupal
4. who created drupal
5. who makes drupal

What
1. what drupal theme is that
2. what drupal is used for
3. what drupal version do i have
4. what drupal version
5. what drupal site

Which
1. which drupal stack is used for installation
2. which drupal version
3. which drupal theme is used
4. which drupal version am i running
5. drupal which database

Where
...

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Domain Knowledge of DropBot

1. greet - hello
2. goodbye - bye
3. affirm - yes
4. deny - no
5. bot_challenge - who are you?
6. define - what is drupal?
7. creator - who created drupal?
8. creation - when was drupal created?
9. release_7 - when was drupal7 released?
10. release_8 - when was d8 released?
11. release_9 - when was d9 released?
12. release_10 - when will d10 be released?
13. end_of_life_7 - when does d7 reach end of life?
14. end_of_life_8 - when does d8 reach end of life?
15. end_of_life_9 - when is d9 no longer supported?
16. end_of_life_10 - when will d10 reach eol?

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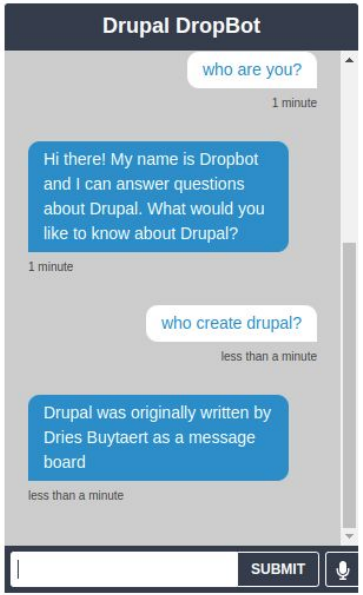
Drupal DropBot

Rasa AI Chatbot



Demo: http://drupalml.com/rasa-chatbot

Sample Questions

Who are you?
Who created Drupal?
When was it created?
When was Drupal7 released?
When was D8 released?
When does D8 reach end of life?
When was d10 released?

Rasa uses port 5005 by default

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Looking to the Future

- Continue to build up Drupal DropBot's knowledge base
- Add a real front-end to DropBot
- I would like to start an initiative for integrating machine learning and AI into Drupal. If you would like to help with this, please let me know: ricktorzynski@gmail.com
- I would like to start a YouTube channel featuring tutorials on integrated machine learning into Drupal

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Thank You!

- Matt Pritchard, Chris McGrath and my colleagues at Esteemed!
- All Florida Drupal Camp organizers and volunteers!
- I apologize for not being able to present this at Florida Drupal Camp, but a family emergency came up and I had to return to Jacksonville Florida