CHATBOTS AND NLP

Social Data Science
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OUTLINE

- Installations
  - https://github.com/doctorunc/SDSBotPresentation
- Overview of Chatbots
  - Types of Chatbots
- Product Development
  - Objectives, Design, Architecture, Prototyping
  - Bot Lifecycle
- Build Q&A Bot
- Questions?
- Wrap Up

INSTALLATIONS

Frameworks

* Anaconda
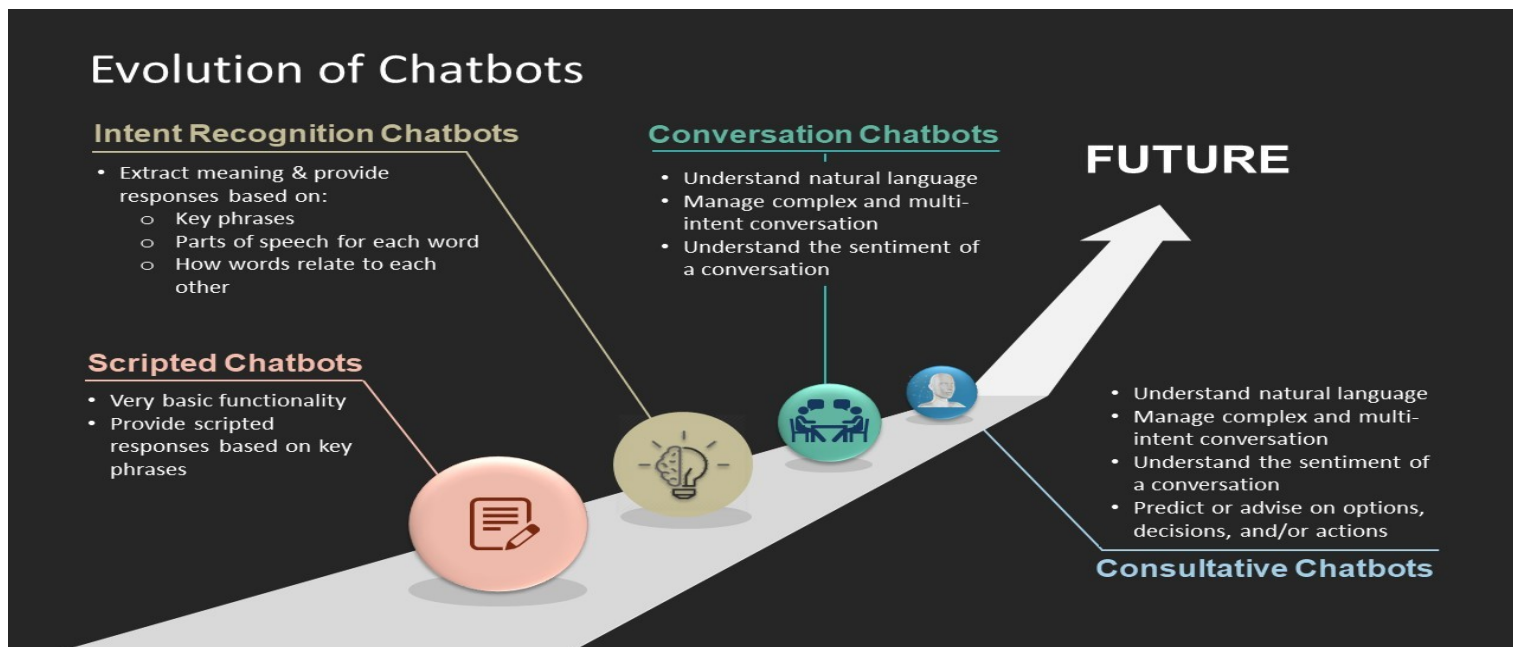   * Jupyter Notebook

Languages

* Python (with Anaconda)

Dependencies

* Pip (file manager)
* Spacy (NLP tasks)
* Numpy, pandas (data)
* Keras (deep learning)
* Matplotlib (graph plots)
* Nltk (NLP tasks)
* Scikitlearn (ML)

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OVERVIEW OF CHATBOTS

* What is a chatbot?
    * Types of chatbots
* Product Development
    * Bot objectives
    * Bot design
    * Bot architecture
    * Bot prototyping

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OVERVIEW OF CHATBOTS

Evolution of Chatbots

Intent Recognition Chatbots
- Extract meaning & provide responses based on:
  - Key phrases
  - Parts of speech for each word
  - How words relate to each other

Conversation Chatbots
- Understand natural language
- Manage complex and multi-intent conversation
- Understand the sentiment of a conversation

FUTURE

Scripted Chatbots
- Very basic functionality
- Provide scripted responses based on key phrases

- Understand natural language
- Manage complex and multi-intent conversation
- Understand the sentiment of a conversation
- Predict or advise on options, decisions, and/or actions

Consultative Chatbots

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OVERVIEW OF CHATBOTS

* Types of Bots
  * Simple (scripted or hard-coded)
  * Responsive (intent recognition)
  * Adaptive (NLU)
  * Consultative (NLG)

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TYPES OF CHATBOTS

Simple (hard-coded)

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TYPES OF CHATBOTS

Responsive (intent recognition)

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TYPES OF CHATBOTS

Adaptive (NLU)

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TYPES OF CHATBOTS

Consultative (NLG)
No example right now –
under construction

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R E S E A R C H
C O R P O R A T I O N

OVERVIEW OF CHATBOTS

- ✓ What is a chatbot?
  - ✓ Types of chatbots
- ∗ Product Development
  - ∗ Bot objectives
  - ∗ Bot design (anatomy)
  - ∗ Bot architecture (components)
  - ∗ Bot prototyping (tools)

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PRODUCT DEVELOPMENT
Bot Objectives

* What do you want your bot to do?
  * Conversation or Dialogue Flow
  * Process Flow & Development Objectives
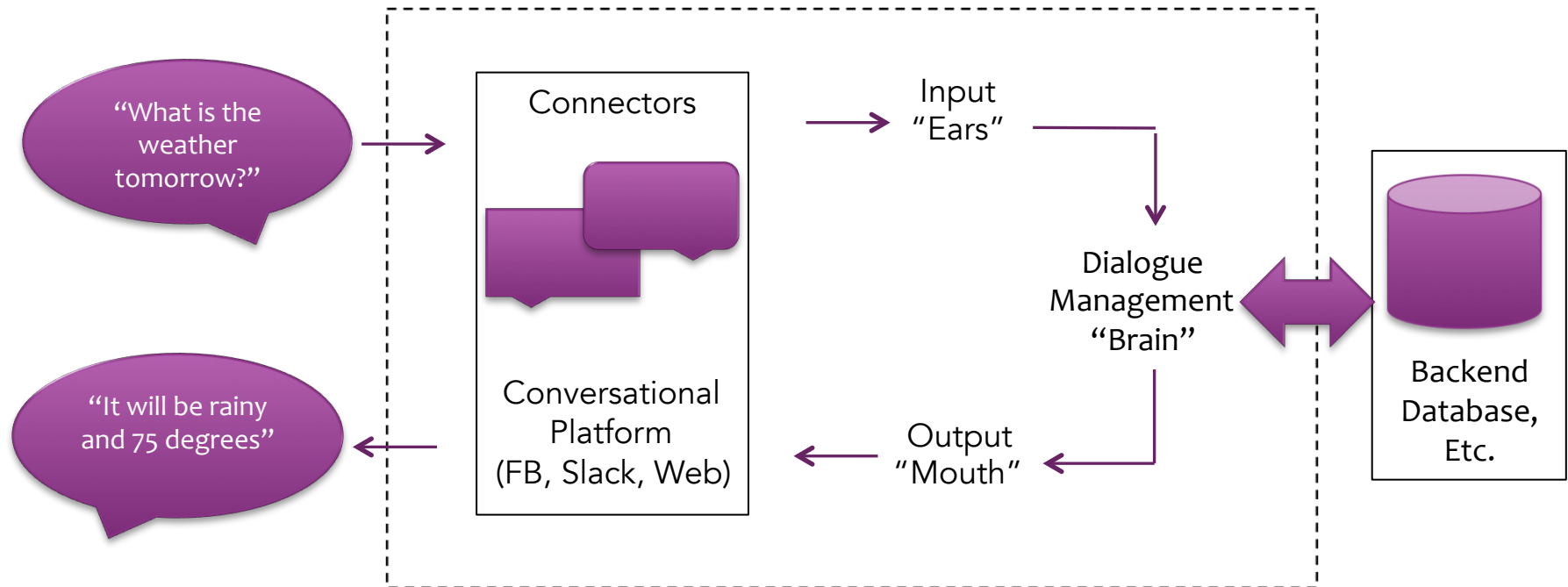 * Stories, Skits, Discussions, etc.

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PRODUCT DEVELOPMENT
Bot Design

- ✓ Type of Bot
- ∗ Product Development
  - ✓ Bot objectives
    - ✓ Integrate conversation flow with bot objectives
  - ∗ Bot design
    - ∗ User text or utterances (what the user says)
    - ∗ Intents or what does the user mean?
    - ∗ Entities or useful information to drive a response
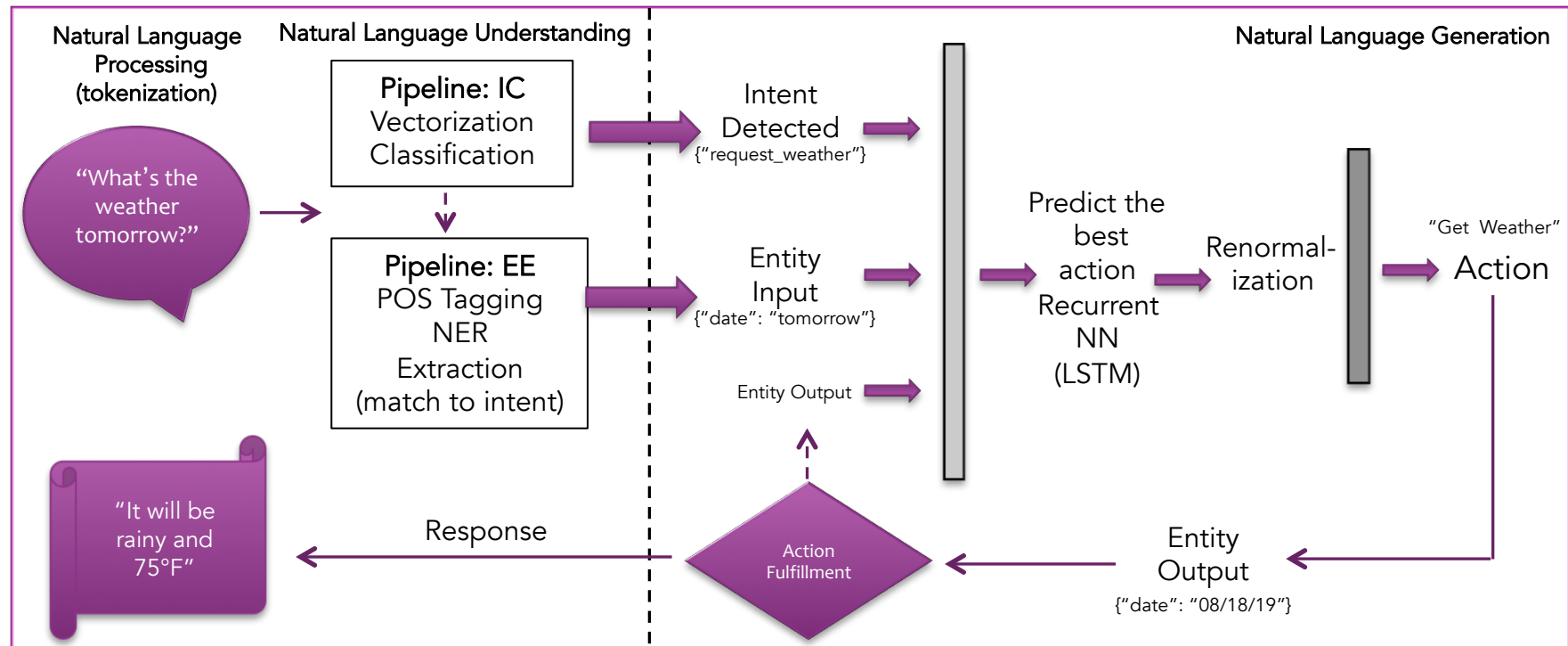   - ∗ Actions or what do you want the bot to do?

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PRODUCT DEVELOPMENT
Bot Design

"What is the weather tomorrow?"

"It will be rainy and 75 degrees"

Connectors

Conversational Platform (FB, Slack, Web)

Input "Ears"

Dialogue Management "Brain"

Output "Mouth"

Backend Database, Etc.

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PRODUCT DEVELOPMENT
Bot Architecture

Natural Language Processing (tokenization)

Natural Language Understanding

Natural Language Generation

"What's the weather tomorrow?"

Pipeline: IC
Vectorization
Classification

Pipeline: EE
POS Tagging
NER
Extraction
(match to intent)

Intent Detected
{"request_weather"}

Entity Input
{"date": "tomorrow"}

Entity Output

Predict the best action
Recurrent NN (LSTM)

Renormal-ization

"Get Weather"
Action

Entity Output
{"date": "08/18/19"}

Action Fulfillment

Response

"It will be rainy and 75°F"

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PRODUCT DEVELOPMENT
Bot Design

Figure: Process Flow and Development Objectives of ReaCTrack

PRODUCT DEVELOPMENT
Bot Design

Bot objectives

1. Monitor severity of depression

2. Track medication adherence

3. Collect and document side effects and adverse reactions

4. Answer domain specific questions

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PRODUCT DEVELOPMENT
Bot Design

* Bot design
    * Intent Detection and Classification
        * 4 + 3 (hello, goodbye, fallback)
    * Entity Extraction
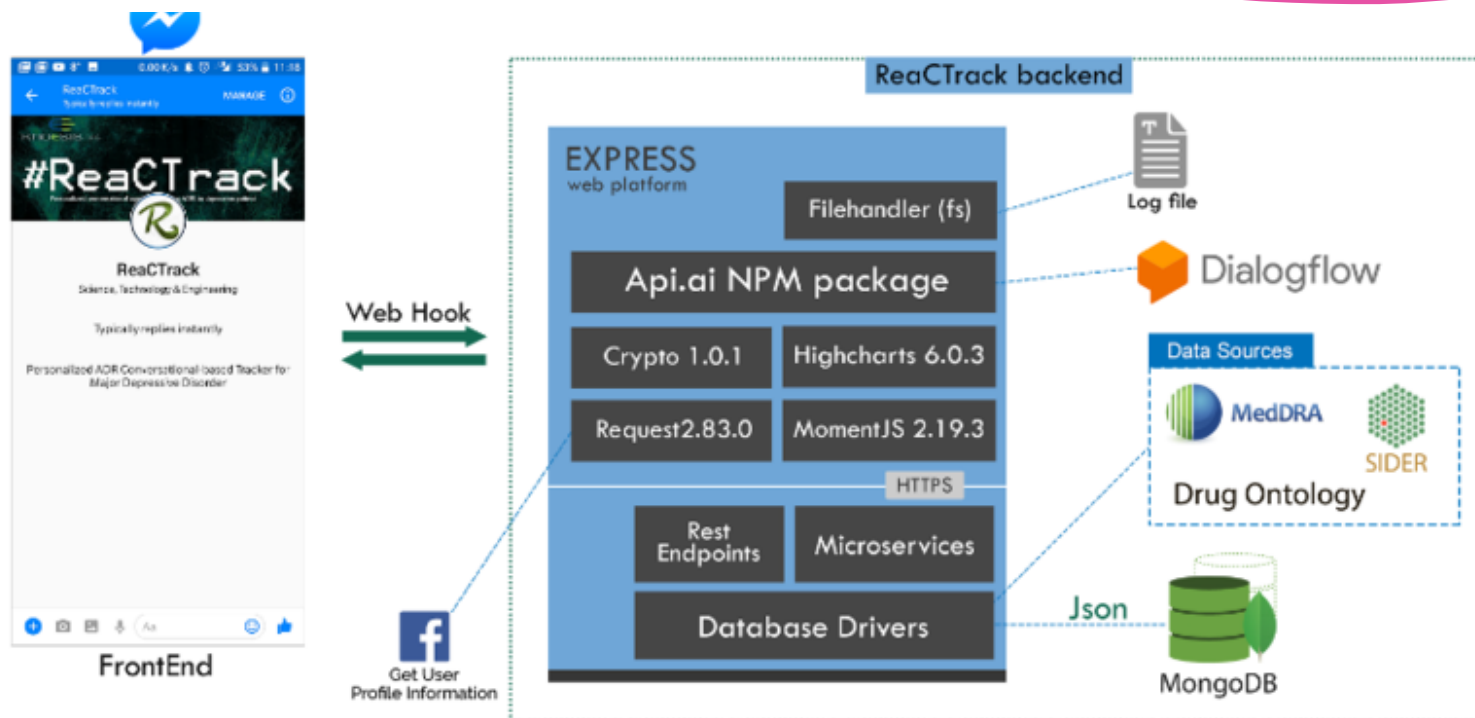   * Actions – scored using machine/deep learning
    * Response

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PRODUCT DEVELOPMENT
Bot Design

- ✓ Type of Bot
- ✓ Design
- ∗ Architecture (components)
  - ∗ Frontend
  - ∗ Webhooks
  - ∗ Backend

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PRODUCT DEVELOPMENT
Bot Architecture

PRODUCT DEVELOPMENT
Bot Design

- ✓ Type of Bot
- ✓ Design (anatomy)
- ∗ Architecture (components)
  - ∗ Frontend – mobile app
  - ∗ Webhooks – 6
  - ∗ Backend
    - ∗ Storage (chatlogs), APIs, others

PRODUCT DEVELOPMENT
Bot Design

- ✓ Type of Bot
- ✓ Design (anatomy)
- ✓ Architecture (components)
- ✓ Prototyping
  - ∗ Platforms?
  - ∗ From scratch?

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PRODUCT DEVELOPMENT
Bot Prototyping

* DialogFlow – Google Cloud Platform
* Amazon Lex – Amazon Web Services
* Microsoft Azure
* IBM Watson
* Others - Rasa

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PRODUCT DEVELOPMENT
Bot Lifecycle

* Phase 1: Design l Architecture l Prototype
* Phase 2: Beta Testing (break the bot!!!)
* Phase 3: Deployment
* Phase 4: Post-deployment (updates, etc.)

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BUILD A Q&A BOT

* Bot Objectives
  * Question & Answer
* Bot Design
  * Simple (no API call) + Memory
* Bot Architecture ("Seq2Vec")
  * RNN/LSTM
    * Utterances – Stories
    * Intents and Entities – Question
    * Action - Answer
* Bot Prototype
  * Python, Keras, Tensorflow

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BUILD A Q&A BOT
Bot Architecture

* Bot Prototype
  * Data Pipeline:
    * Dataset: Babi Dataset from Facebook Research
    * ETL: pickle files (train + test data)
    * EDA: basics + model variables
    * Preprocessing: NLP – vectorize the data
    * Model creation ("Seq2Vec")
      * RNN/LSTM
      * Intent detection
      * Entity extraction
      * Answer generation
  * Model evaluation
  * Model deployment (pre-trained models)

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QUESTIONS?

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WRAP UP

* Summary
* Follow Up
* Additional Resources
* Other?

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THANK YOU!!!

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