Intent Sets - Architectural Choices for Building Practical Chatbots

Saurabh Srivastava, T.V. Prabhakar

Department of Computer Science & Engineering, IIT Kanpur, India

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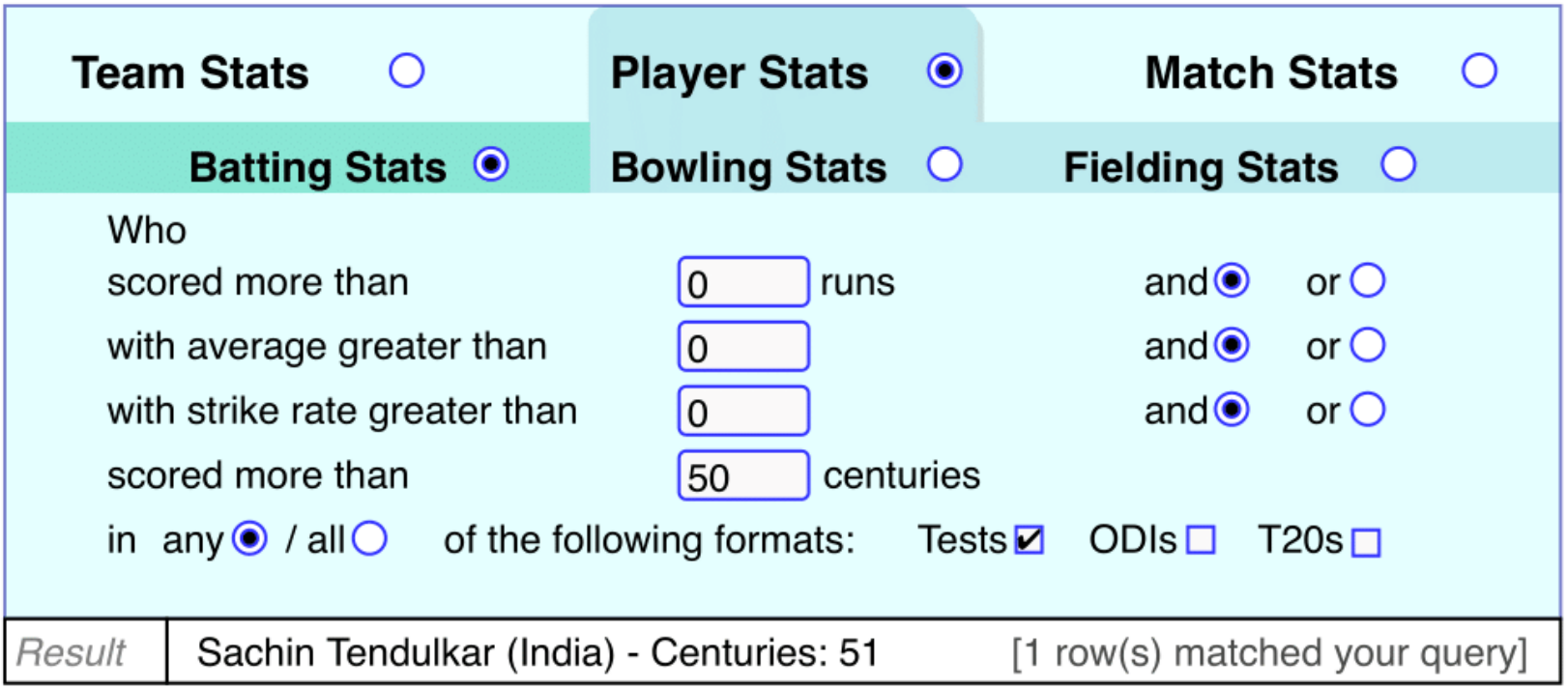
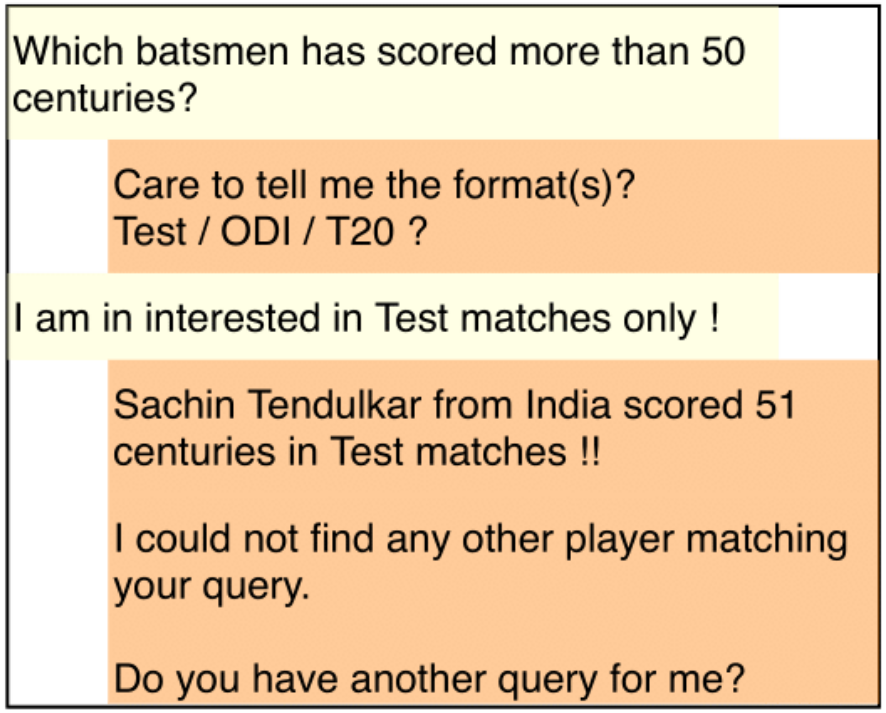
Introduction – What is a **Chatbot**?

- A colloquial term used to refer to a conversational software component
- Interacts with the user, either through voice or text, using some Natural Language like English
- Often added to an existing system, to provide a conversational querying interface over some data
- There are commercial platforms which can aid in designing, implementing and deploying these chatbots
- Examples: Google Dialogflow, IBM Watson Assistant, Amazon Lex

QBE vs Conversational Interface



QBE Interface



Chatbot

Elements of a Chatbot's definition

- Almost all platforms today seek 4 elements to build a chatbot
- **Intents**
  - Broad categories of queries the chatbot will be serving
- **Entities**
  - Real-world actors which will appear in queries
- **Sample Queries**
  - Examples of possible queries that the chatbot will receive
- **Fulfilments**
  - Background business logic to be invoked to process a query

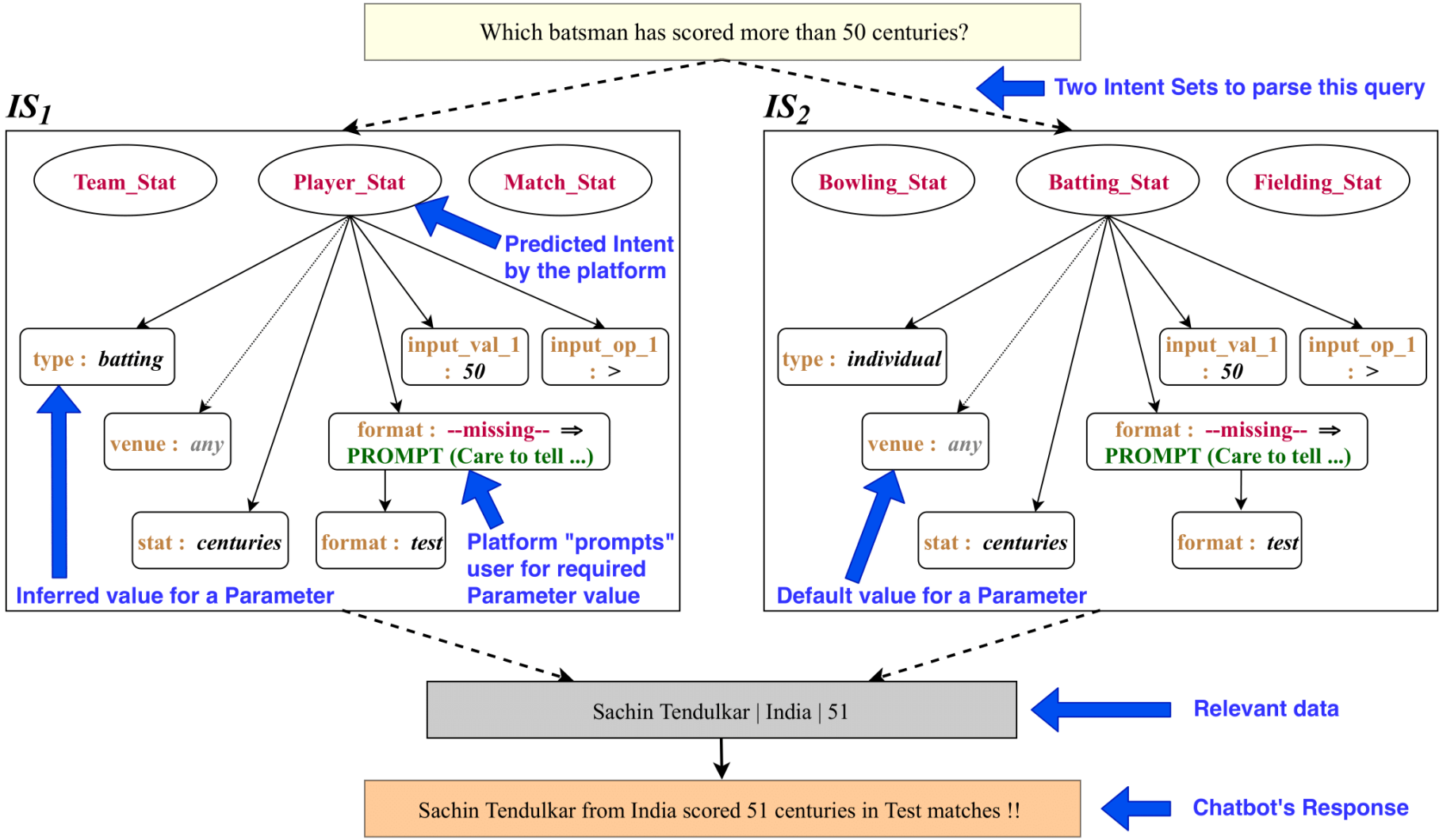
Sample Formulations

- *Query* - "What's the price for a large double-cheese Margherita?"
- Sample Formulation 1:
  - Intents: garlic_bread_query | pizza_query | choco_lava_cake_query
  - Entities: Product_Type: *Margherita*, Product_Size: *Large,*
    Additional_Req: "double-cheese"
- Sample Formulation 2:
  - Intents: small_sized_order | medium_sized_order | large_sized_order
  - Entities: Product_Name: *Pizza*, Product_Type: *Margherita*,
    Additional_Req: "double-cheese"

Intent Sets - Definition

An Intent Set is a collection of Intents and their associated Parameters, which can collectively cover all possible queries that a chatbot may encounter.

Intent Sets – Example



Intent Sets – Properties

- *If the platform maps every query to the correct Intent, and parses all the Parameter values correctly, then the response produced by any Intent Set for a given chatbot is exactly the same.*
- *An Intent Set divides the real-world into a finite number of disjoint scenarios, the union of which, constitutes all possibilities that the chatbot can handle.*

Experiments – Overview

- We built a chatbot, called *Cricket Novice* using three different platforms – Google Dialogflow, IBM Watson Assistant and Amazon Lex
- The chatbot could answer some queries about the game of Cricket, such as how the game is played, the formats, team composition etc.
- In addition, we choose 35 rows of statistics about individual performances from ESPNCricinfo Statsguru, for which Cricket Novice acts like a conversational querying interface
- In total, we created 25 Intents with a static, descriptive response, and some other Intents to cater to the tabular data

Experiments – Setup

- To handle the tabular data, we created two Intent Sets
- We choose a fixed set of 105 Sample Queries, to be used for training chatbots with both Intent Sets
- These queries were divided into three groups, and the chatbot was trainied in three passes, in a cummulative fashion
- We choose a fixed set of 20 Queries, not used during the training, to test the response of the chatbot
- We defined a metric called **Utility Score** which measured the accuracy of the chatbot after each pass
- In A fourth pass, we also provided some *Negative Examples* to the chatbot, to cover out-of-scope queries and improve accuracy

Match Type	Stat Span	Stat $Type_1$	Stat $Type_2$	Stat	Player	Team	Details
test	innings	highest	batting	runs	Brian Lara	West Indies	scored 400* runs
odi	career	highest	bowling	wickets	Muttiah Muralitharan	Sri Lanka	took 534 wickets
odi	career	lowest	bowling	strike rate	Rashid Khan	Afghanistan	bowled 2623 deliveries
test	career	highest	batting	average	Sir Donald Bradman	Pakistan	had an average of 99.94
t20	innings	highest	batting	strike rate	Dwayne Smith	West Indies	had a strike rate of 414.28
t20	career	highest	batting	centuries	Rohit Sharma	India	scored 4 centuries
t20	career	lowest	bowling	average	Rashid Khan	Afghanistan	has an average of 12.4
t20	career	lowest	bowling	economy rate	Daniel Vettori	New Zealand	had economy rate of 5.7
test	innings	best	bowling	figures	Jim Laker	England	had figures of 51.2-23-10-53
test	career	highest	batting	centuries	Sachin Tendulkar	India	scored 51 centuries
test	career	highest	batting	double centuries	Sir Donald Bradman	Australia	scored 12 double centuries

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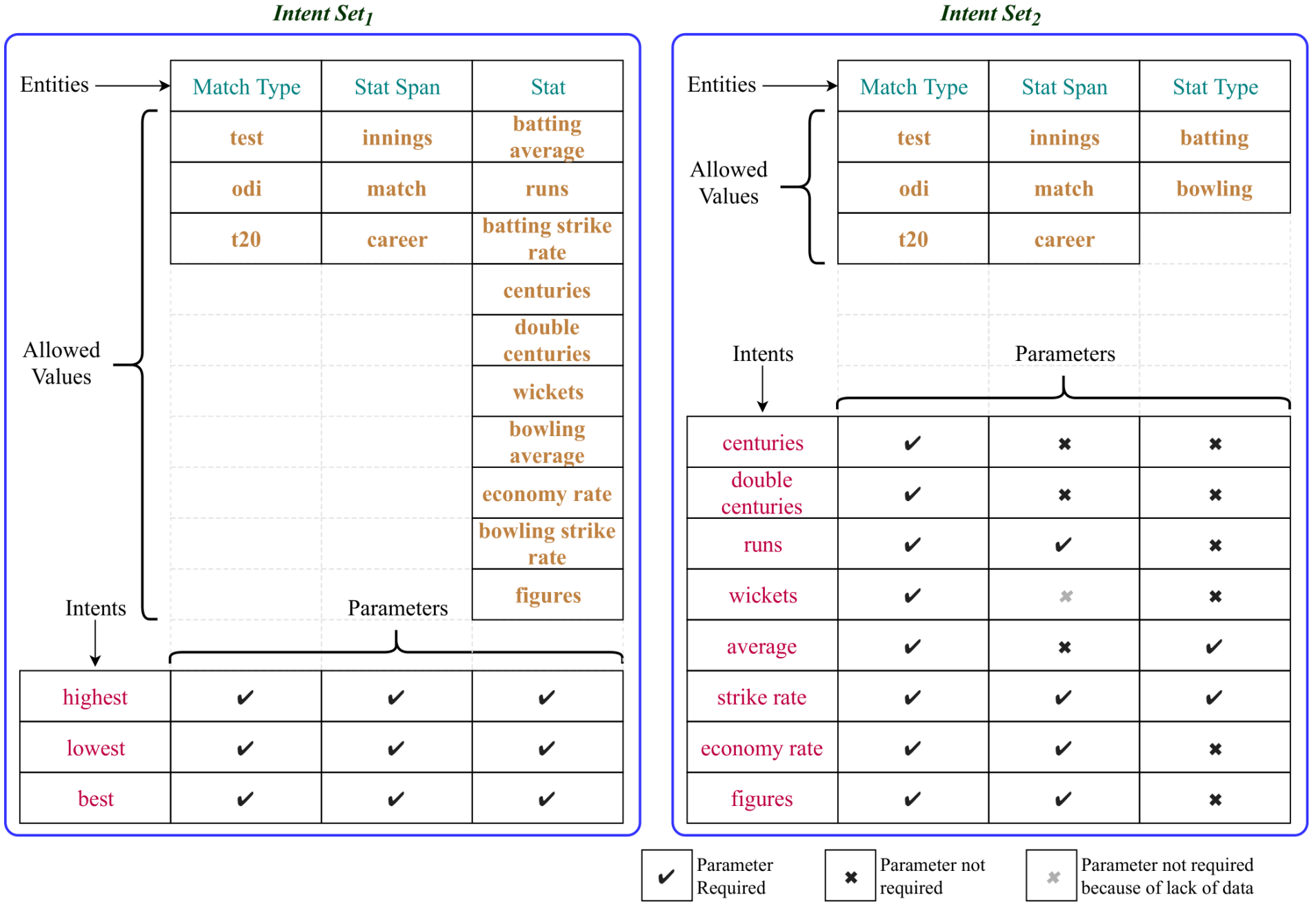
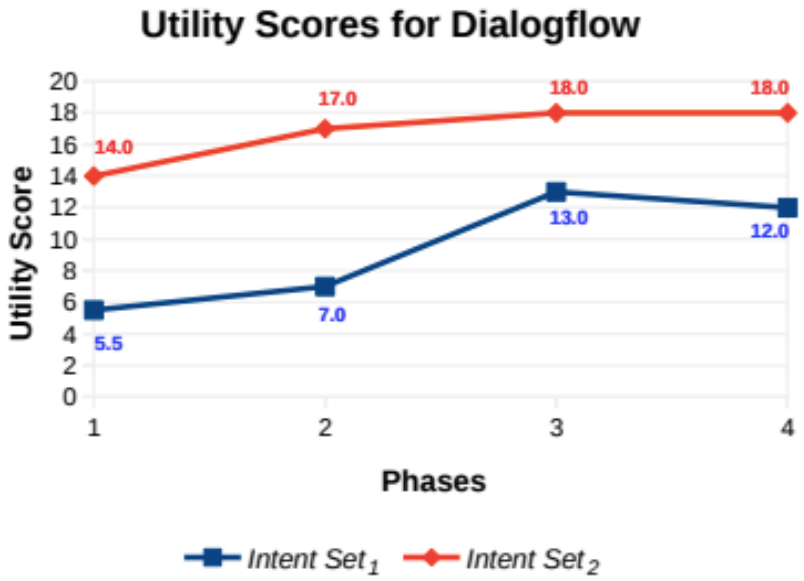
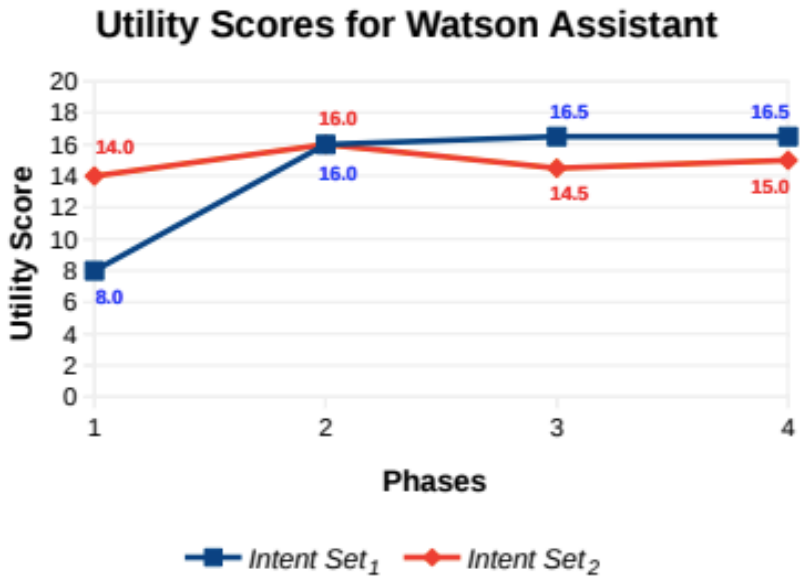
Some of the stats known to the Cricket Novice. The shaded columns are used by the bot to stitch a response.

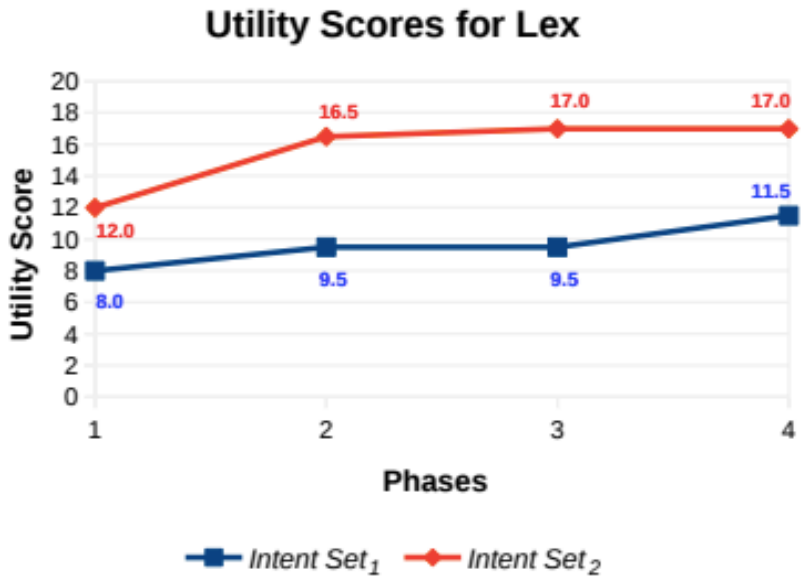


Statistical Intents for Cricket Novice. The Descriptive and `default` Intents were common

Experiments – Observations







Conclusion

- Picking an Intent Set for a chatbot is a *Principle Design Decision*
  - Picking one Intent Set over another can produce chatbots with widely varying behaviours
- Some Intent Set may be a better choice on one platform, but may not do well on another platform
  - Since platforms do not disclose the background process used to build a chatbot, it cannot be predicted beforehand

Thanks for your time !

- A version of Cricket Novice chatbot - https://bot.dialogflow.com/aca181a6-0769-41f6-a4ed-bcd945380ef2
- Questions?