Omilia | Technology that Listens, Understands and Cares

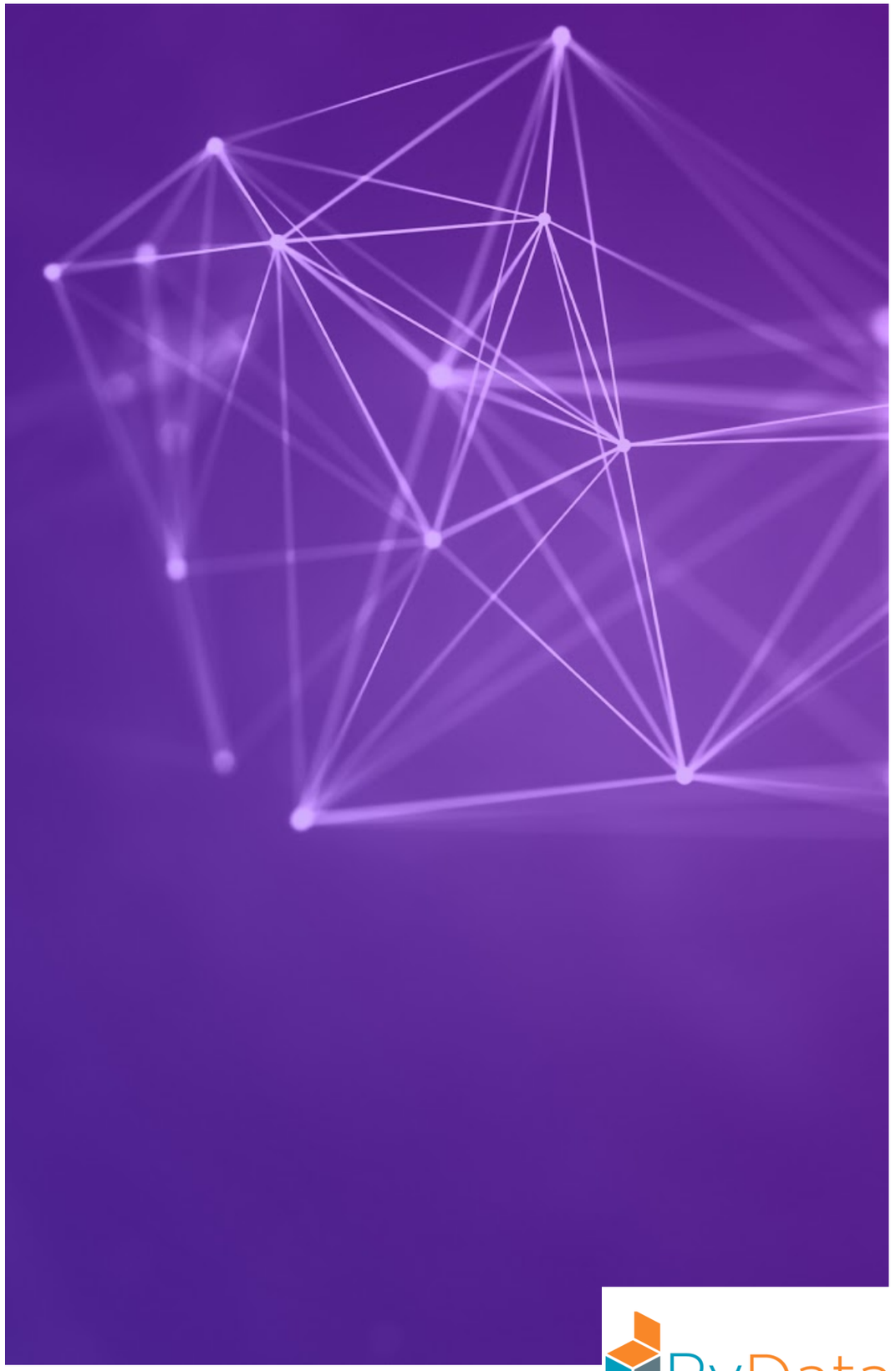
INTENT CLASSIFICATION ON DIALOGS

PyData Piraeus

27 September, 2019

Outline

- Introduction
- Architecture
- Performance
- Conclusions



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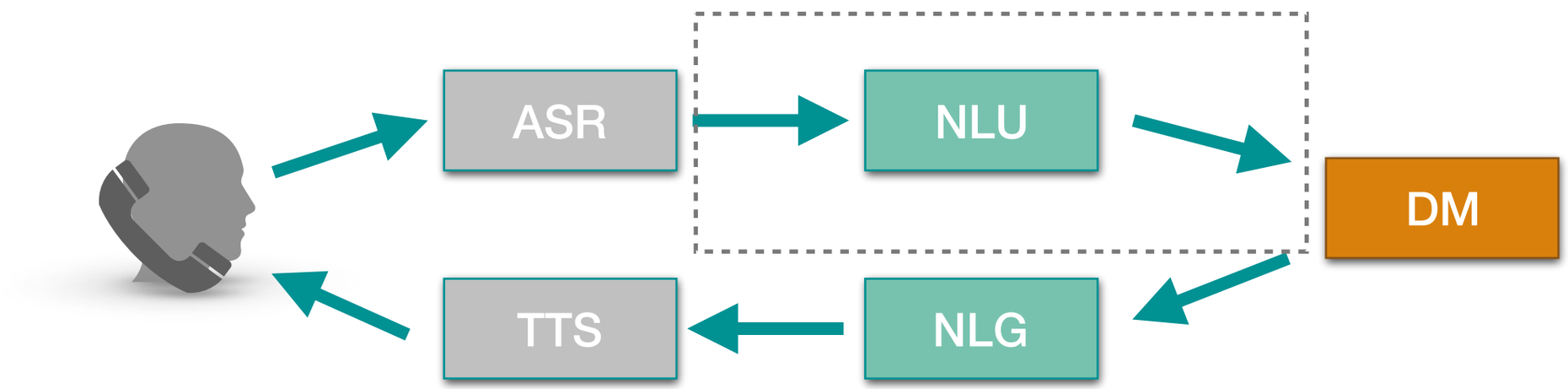
INTRODUCTION

Introduction: NLU in Dialogue Systems

- Typical interaction components:
  - **A**utomatic **S**peech **R**ecognition (ASR), **N**atural **L**anguage **U**nderstanding (NLU), **D**ialogue **M**anager (DM), **N**atural **L**anguage **G**eneration (NLG), **T**ext **T**o **S**peech (TTS)



- Challenges: ASR errors, nature of the language, e.g., spontaneous speech, ambiguity, ground-truth labels etc.
- NLU tries to understand user utterances. It breaks them into task specific semantic representations, e.g., intents
- Dialogue Manager updates the dialogue flow based on these representations

Introduction: NLU components

- NLU typically includes both intent classification and slot filling
- Intent: The intentions of the user during interaction
- Entity (slot): Semantic concepts. An entity modifies an intent
- Most common application: chatbot

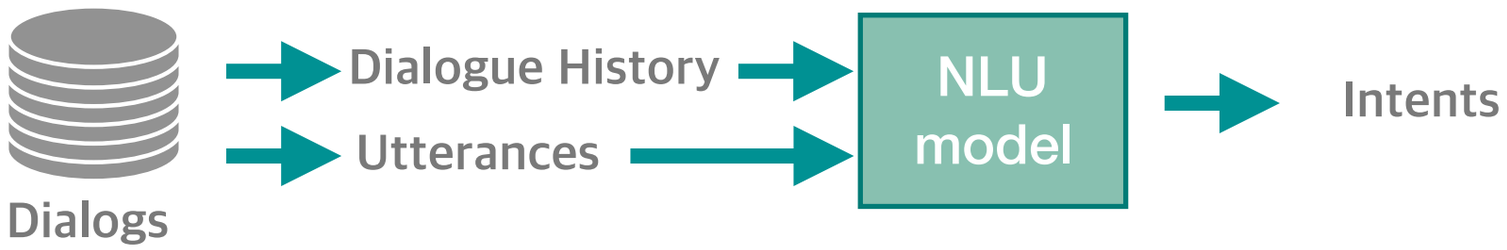
utterance

intent: bookFlight

Slot (destination): New York

Introduction: Goal & Approach

- Goal : Intent classification on utterance level using the dialogue context (dialogue history)
- Motivation : Dialogue context contains useful information that is expected to contribute to a more accurate (intent) decision



- NLU model can be :
  - *Rule-based:* match manually design pattern sequences
  - *Statistical*: Feature extraction (e.g., ngrams, POS tags) + Machine learning model (e.g., Naive Bayes, Decision trees)
  - *Neural Networks*: End-to-end approach without manual feature extraction

ARCHITECTURE

ARCHITECTURE: Problem definition

- Language:  US- English
- Domain:  Banking, American Bank
- Tasks: Intent classification & slot filling
- NLU model: Neural networks: Deep **R**ecurrent **N**eural **N**etwork (RNN) architecture
  - Features: Word Embeddings
  - RNNs: Long-short Term Memory (LSTMs), Gated Recurrent unit (GRUs)

- Dialogues: ~ 40K
- Intents: 67

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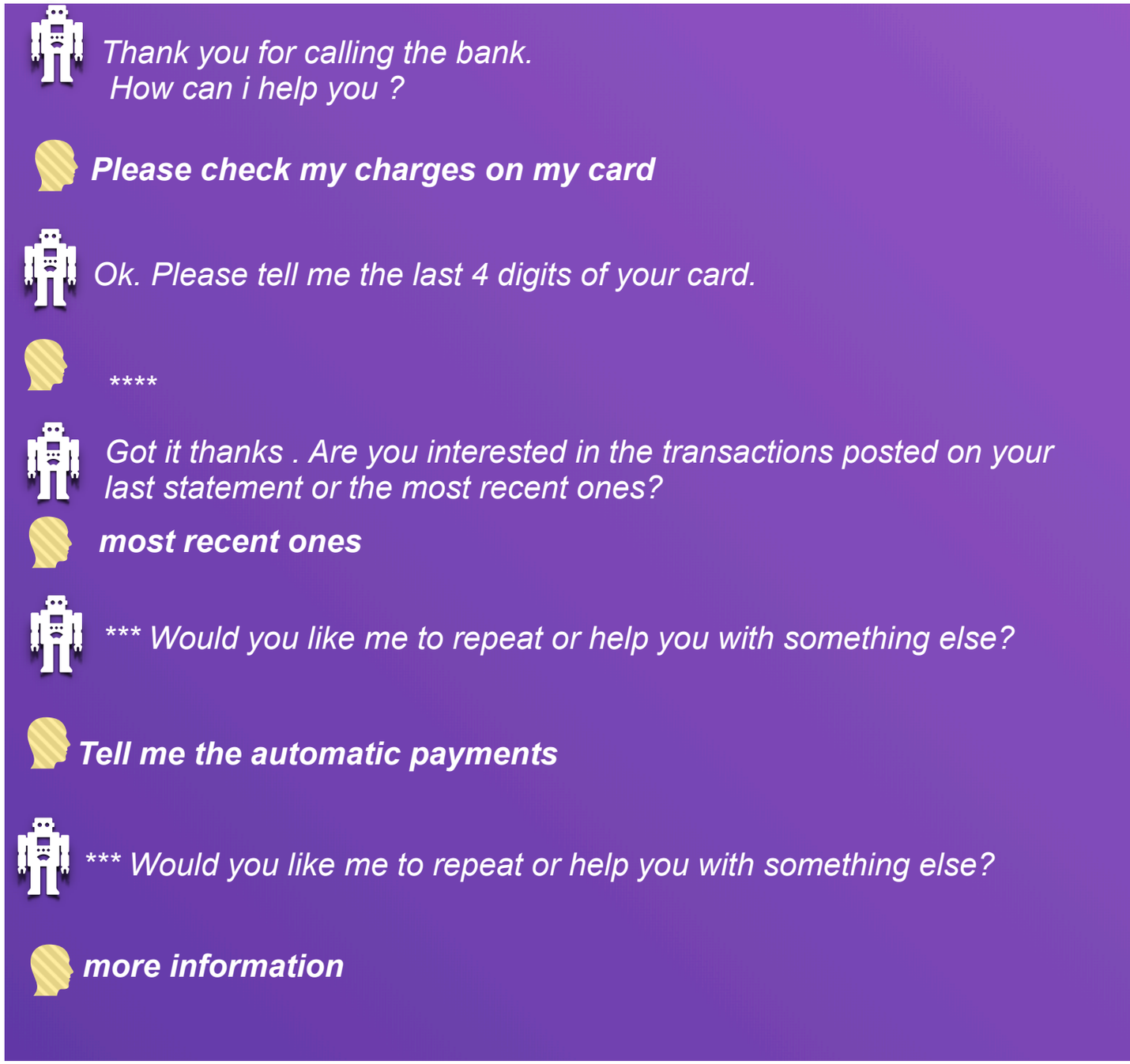
Intent classification challenge

- Challenging task due to supporting natural interaction between humans and computers
- Users pick up their phone, ask something and NLU model detects the intent based on the dialog
- Intent classes:
  - Can overlap
  - Can be ambiguous
  - Can have very close meaning between each other
  - Are not equally frequent

Importance of dialogue context

- Dialogue context contains information that can contribute to a more accurate prediction
- In the example we observe that the utterance “more information” is too generic without the dialog context
- However, providing the model with the dialogue context we help it to understand that “more information” refers to the automatic payments
- Related intents are: Information, Payment-Automatic_Information



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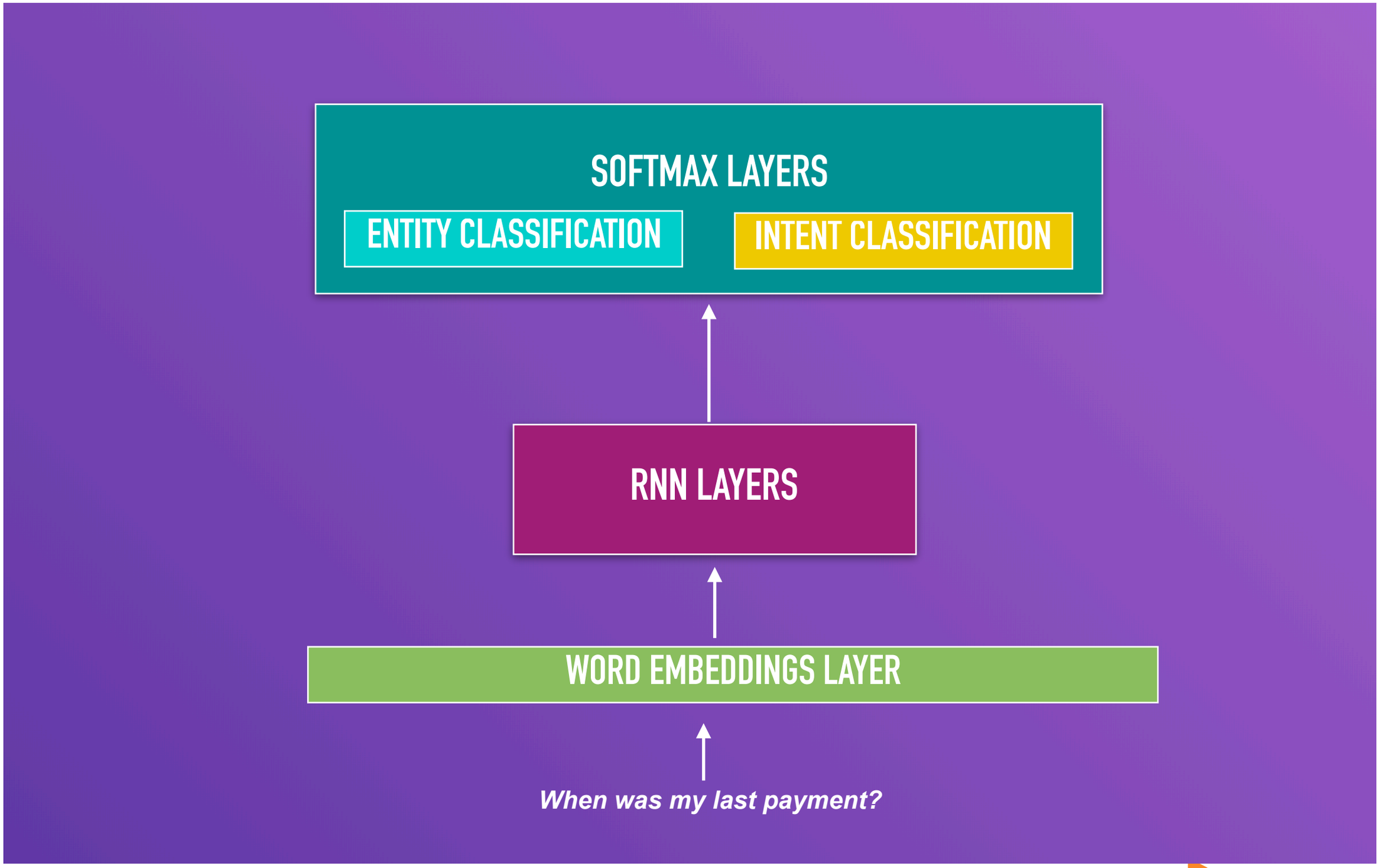
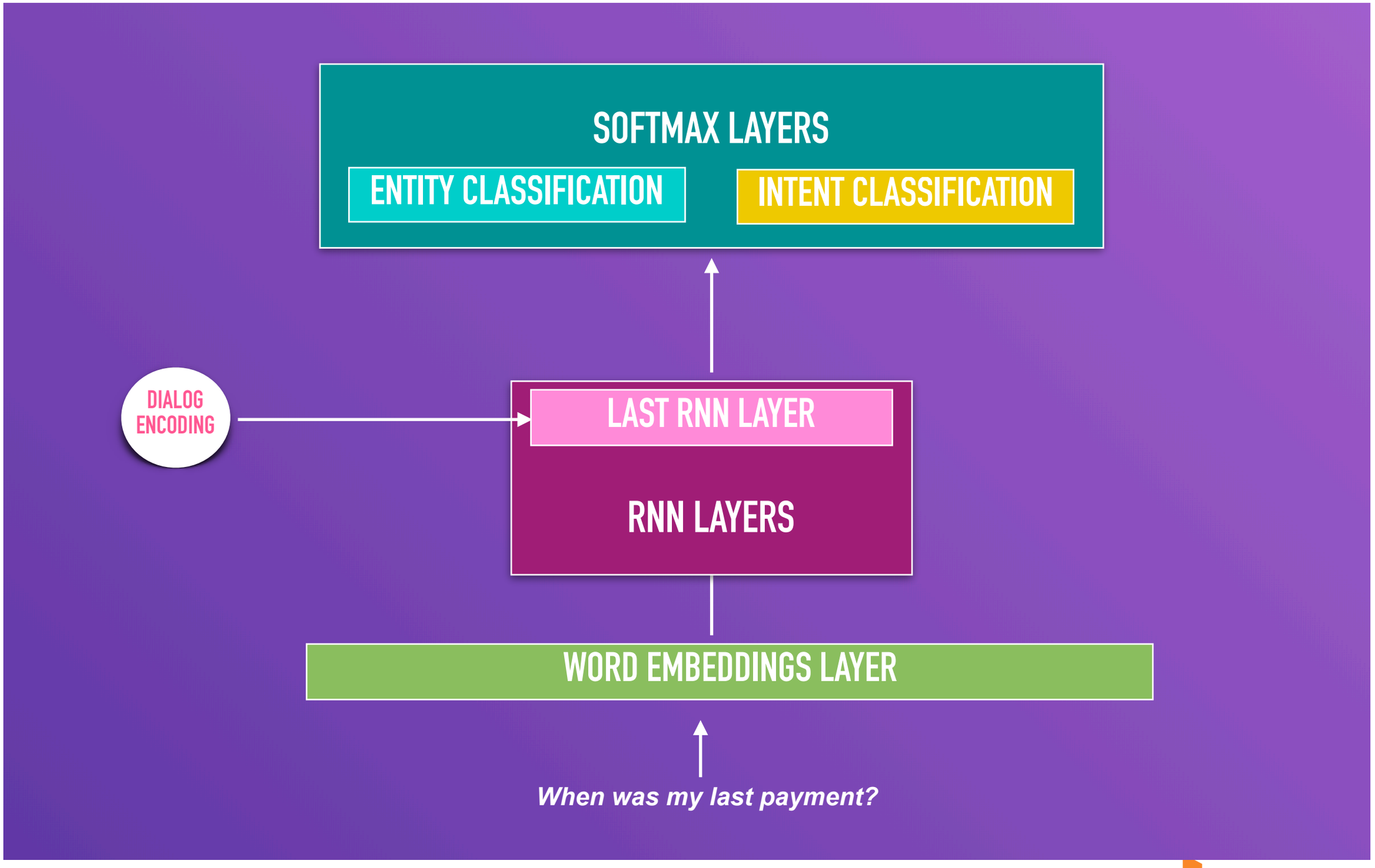
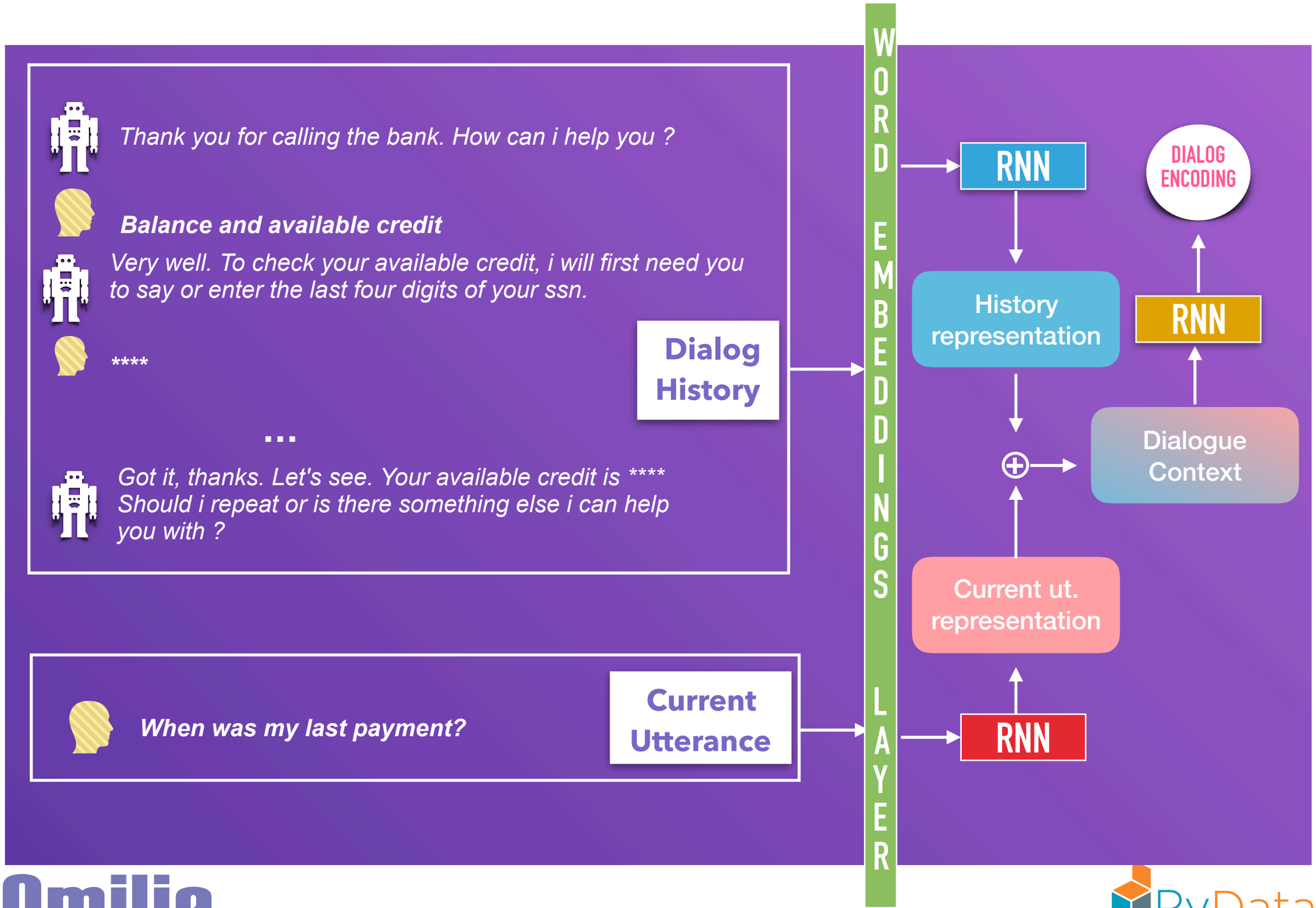
ARCHITECTURE: Intent Classification - One utterance



ARCHITECTURE: Intent Classification - Dialog Encoding



ARCHITECTURE: Dialog Encoder



PERFORMANCE

PERFORMANCE: Training requirements

- Training ..
  - for 40 epochs
  - on 1 GPU
  - for ~50min per epoch
- Tools & libraries

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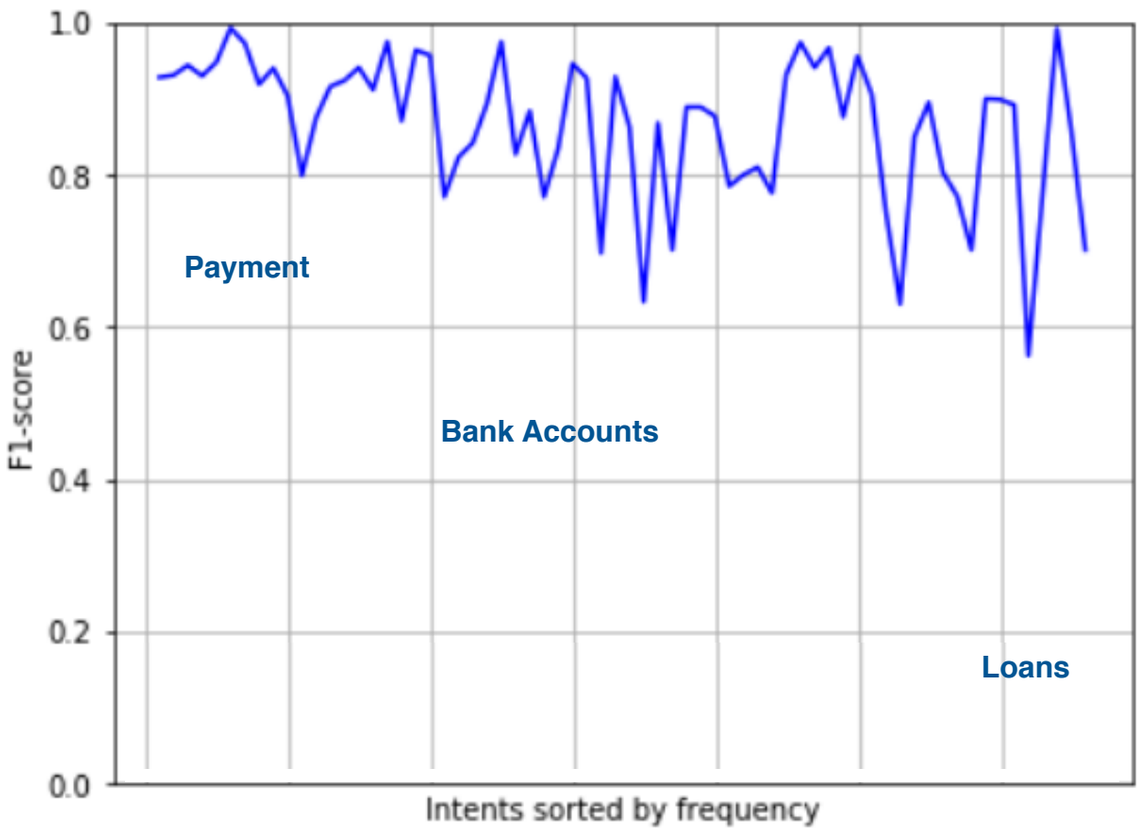
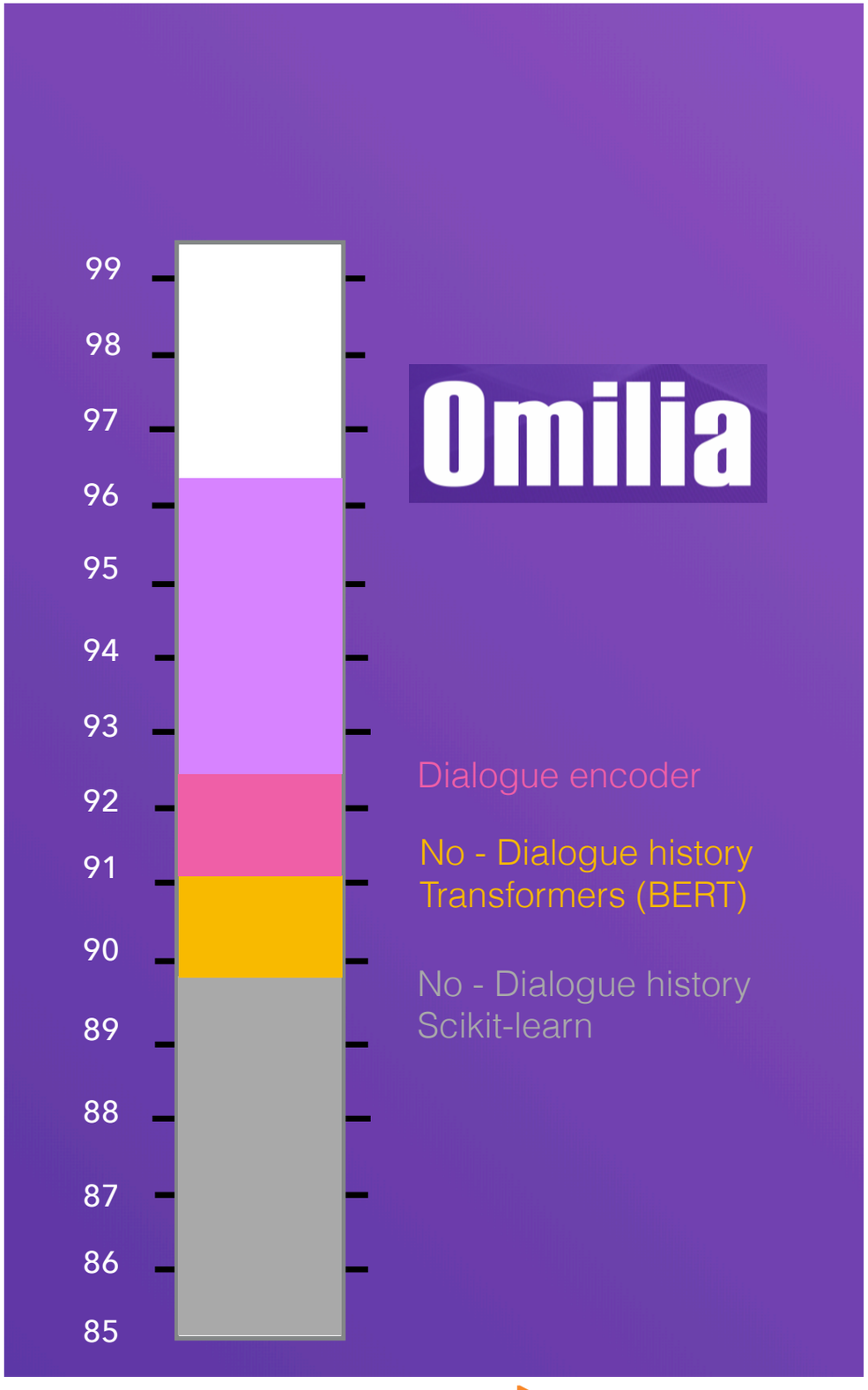
PERFORMANCE: Evaluation

- Intent Classification Accuracy / Error, F-Score
- Dialogue encoder achieves ~ 92.6 % classification accuracy (~7.4 error)
- With extra features used at Omilia reached 96.2 classification accuracy (~ 3.8 error)





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CONCLUSIONS

Conclusions

- NLU is a very challenging NLP subfield
- Intent classification is a crucial task for successful communication between humans and machines
- Advanced NLU models like Neural networks are required in order to handle the challenging
- Dialogue context helps