NLP intent detector

TEAM

CSANDU & HHOREA

Quick Intro

Our solution is layered

On top of the intent file given, we built a second information layer
It has the purpose of structuring & augmentation
We will refer to it as the knowledge base

On top of the knowledge base we built a prolog file.
It has the purpose of intent detection and filtering
We will refer to it as the kernel

On top of the kernel we built a python abstraction wrapper
It has the purpose of intent discrimination and control
We will refer to it as the wrapper

And the wrapper is a friend of Google API

Supported requests

The following forms are currently supported:

Add Event

- Fully Functional
- Google API capable

Ask Event

- Functional structure

Ask Weather

- Basic structure

Set Temperature

- Basic structure

Actions taken based on form

Valid

- Complete Form
  - Base case
    - Send Intent
- Incomplete Form
  - Number of defaults (missing words)
    - Has one
      - Q: Confirmation
    - Has many
      - Q: Repeat the sentence

Invalid

- Premature Ending
  - Q: Repeat the sentence
- Malformed word
  - Number of leaves(final flags)
    - Has none
      - Q: Repeat the whole sentence
    - Otherwise
      - Q: Continue from the longest valid prefix

Knowledge Base
The Structure

The nodes represent words or variables from the knowledge base sentence – making this a tree in which leaves that have the _isFinal flag can be used as valid sentences.

The redundant data is eliminated by using common prefixes. The branches are specified only once as a direct child of each root de of the JSON tree root descendants.

For each node a series of flags are defined (see more information on the next slide).

On the right side you can see that "@[data]" is specified in both "adaugaEvent" and "intreabaEvent", as they are different requests.

KB flags

Are extra tags added in the knowledge base in order to discriminate:

- _default: specify a default value for a given key in the Knowledge Base JSON
- _canAbsent: the search is continued skipping the node having this key.
- _isFinal: this flag defines when a sentence has ended.

Other such tags can be added in order to further scale the complexity of the solution.

Case study FAQ

Case studies contain the following:

- 1) The request input, as a json that contains the specified tags
- 2) The knowledge base subtree associated with such an input
  - Is entirely based on the intent description file
  - Can be customized depending on logic preference with tags
  - Can specify any corner cases too!
- 3) The resulted output – with data and potential questions
  - We also have a *special* slide for the google calendar event addition

Case Study #1:

VALID – Complete Form - Add event

Input as JSON

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] pe @[data] intre @[ora_inceput] si @[ora_final]",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30",
        "@[ora_inceput]" : "9:00",
        "@[ora_final]" : "10:30"
    }
}
```

Knowledge Base

```
"adaugaEvent" : {
    "@[event]" : {
        "pe" : {
            "_canAbsent" : "true",
            "@[data]" : "@[data]"
        }
    }
},
"@[data]" : {
    "_isFinal" : "true",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
```

Highlighted in the knowledge base you can see the instance of _isFinal that triggered the result. Output contains only information from the input.

We consider this the base case.

```
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30', 'ora_inceput': '9:00', 'ora_final': '10:30'}
Posibila intrebare:  None
```

Case Study #2:

VALID – Incomplete form - One default

Input as JSON

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] pe @[data] intre @[ora_inceput] si @[ora_final]",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30",
        "@[ora_inceput]" : "9:00"
    }
}
```

Highlighted in the knowledge base you can see a sample of default which worked as a placeholder for a _isFinal instance which produced the following output:

Knowledge Base

```
"@[data]" : {
    "_isFinal" : "true",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
    "la" : {
        "_canAbsent" : "true",
        "@[ora_inceput]" : {
            "_default" : "_d8:30",
            "_isFinal" : "true"
        }
    }
}
```

```
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30', 'ora_inceput': '9:00', 'ora_final': '20:00'}
Posibila intrebare:  ASK_DEFAULT ['ora_final']
```

Case Study #3:

VALID – Incomplete form – Two defaults

Input as JSON

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] pe @[data] intre @[ora_inceput] si @[ora_final]",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30"
    }
}
```

Knowledge Base

```
"@[data]" : {
    "_isFinal" : "true",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
    "la" : {
        "_canAbsent" : "true",
        "@[ora_inceput]" : {
            "_default" : "_d8:30",
            "_isFinal" : "true"
        }
    }
}
```

Highlighted in the knowledge base you can see a sample of default which worked as a placeholder for an _isFinal instance which produced the following output, with the second default caught when coming back from the recursion:

Note : It can be changed to ask for confirmation instead.

```
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30', 'ora_inceput': '21:00', 'ora_final': '20:00'}
Posibila intrebare:  REFORMULARE [ALL]
```

Case Study #4:

VALID – Incomplete form – Three defaults or more

Input as JSON

NLU_UTCN-master > Input.txt

```
1  {
2      "actiune" : "adaugaEvent",
3      "parametrii" : {
4          "propozitie" : "@[event] pe @[data] intre @[ora_inceput] si @[ora_final]",
5          "@[data]" : "2020-07-30"
6      }
7  }
8
```

Knowledge Base

```
35      "adaugaEvent" : {
36          "@[event]" : {
37              "_default" : "_dmergi la medic",
38              "pe" : {
39                  "_canAbsent" : "true",
40                  "@[data]" : "@[data]"
41              }
42          }
43      },
```

Highlighted in the knowledge base you can see a sample of default which worked as a placeholder for an _isFinal instance which produced the following output, with the second default caught when coming back from the recursion:

```
Primite:  {'data': '2020-07-30', 'event': 'mergi la medic', 'ora_inceput': '21:00', 'ora_final': '20:00'}
Posibila intrebare:  REFORMULARE [ALL]
```

Case Study #5:

INVALID – Premature Ending

Input as JSON

NLU_UTCN-master > Input.txt

```
1  {
2      "actiune" : "adaugaEvent",
3      "parametrii" : {
4          "propozitie" : "@[event] pe @[data] intre ",
5          "@[event]" : "mergem la cumparaturi",
6          "@[data]" : "2020-07-30",
7          "@[ora_inceput]" : "9:00"
8      }
9  }
10
```

In this case - the input sentence has prematurely ended. In such situations, there is no match in the knowledge base – therefore the system will ask for a full reformulation.

Knowledge Base

```
"adaugaEvent" : {
    "@[event]" : {
        "pe" : {
            "_canAbsent" : "true",
            "@[data]" : "@[data]"
        }
    }
},
"@[data]" : {
    "_isFinal" : "true",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
```

```
Primite:  None
Posibila intrebare:  REFORMULARE [ALL]
```

Case Study #6:

INVALID – Malformed Word – sentence detected

Input as JSON

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] pe @[data] intreA_INVALID @[ora_inceput] si @[ora_final] ",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30",
        "@[ora_inceput]" : "9:00"
    }
}
```

Knowledge Base

```
"adaugaEvent" : {
    "@[event]" : {
        "pe" : {
            "_canAbsent" : "true",
            "@[data]" : "@[data]"
        }
    }
},
"@[data]" : {
    "_isFinal" : "true",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
```

The input sentence contains a malformed word (interA_INVALID) which will produce an error in the knowledge base.
The system will consider the longest sentence prefix valid and as ask for completion of what follows the element specified.*

I.e. : What did you say after [data]?

```
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30'}
Posibila intrebare:  REFORMULARE [data]
```

Case Study #7:

INVALID – Malformed Word – NO sentence detected

Input as JSON

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] peA_INVALID @[data] intre @[ora_inceput] si @[ora_final] ",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30",
        "@[ora_inceput]" : "9:00"
    }
}
```

Knowledge Base

The functionality of the system is similarly to the previous case, but no valid sentence was detected.

```
Primite:  None
Posibila intrebare:  REFORMULARE [ALL]
```

Bonus
Case study #8

Weather

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "intreabaVremea",
    "parametrii" : {
        "propozitie" : "@[loc]"
    }
}
```

Input JSON for Weather

```
{
    "intreabaVremea" : {
        "@[loc]": {
            "_isFinal": "true",
            "_default": "Baia Mare",
            "@[timp]": {
                "_isFinal" : "true"
            }
        },
        "@[timp]": {
            "_isFinal" : "true"
        }
    }
}
```

Knowledge base

```
Primite:  {'loc': 'Baia Mare'}
Posibila intrebare:  None
```

Bonus
Case study #9

Temperature

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "seteazaTemperatura",
    "parametrii" : {
        "propozitie" : "la @[grade] in @[loc]",
        "@[loc]" : "camera de zi"
    }
}
```

Input JSON for Temperature

```
    "seteazaTemperatura" : {
        "la" : {
            "_canAbsent": "true",
            "@[grade]": {
                "_default": "25",
                "in": {
                    "_canAbsent": "true",
                    "@[loc]": {
                        "_isFinal": "true"
                    }
                }
            }
        },
```

Knowledge base

```
Primite:  {'loc': 'camera de zi', 'grade': '25'}
Posibila intrebare:  None
```

Bonus
Case study #10

Ask Event

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "intreabaEvent",
    "parametrii" : {
        "propozitie" : "@[data] la @[ora_inceput]",
        "@[data]": "21:00"
    }
}
```

Input JSON for Ask Event

```
"intreabaEvent" : {
    "@[data]" : "@[data]"
},
"@[data]" : {
    "_isFinal" : "true",
    "_default" : "_d1998-07-22",
    "intre" : {
        "@[ora_inceput]" :{
            "_default" : "_d21:00",
            "si" : {
                "@[ora_final]" : {
                    "_default" : "_d20:00",
                    "_isFinal" : "true"
                }
            }
        }
    },
    "la" : {
        "_canAbsent" : "true",
        "@[ora_inceput]" : {
            "_default" : "_d8:30",
            "_isFinal" : "true"
        }
    }
```

Knowledge base

```
Primite:  {'data': '21:00', 'ora_inceput': '8:30'}
Posibila intrebare:  ASK_DEFAULT ['ora_inceput']
```

GOOGLE API #1

POC for Google calendar API

Working example

NLU_UTCN-master > Input.txt

```
{
    "actiune" : "adaugaEvent",
    "parametrii" : {
        "propozitie" : "@[event] pe @[data] intre @[ora_inceput] si @[ora_final]",
        "@[event]" : "mergem la cumparaturi",
        "@[data]" : "2020-07-30",
        "@[ora_inceput]" : "9:00",
        "@[ora_final]" : "10:30"
    }
}
```

We start here

First – we have to call Google API to generate an authentication link

```
PROBLEMS 1  OUTPUT  DEBUG CONSOLE  TERMINAL                                  1: python3

ubtest@ubTest-Computer:~/NLU_UTCN-master$ python3 main.py
None
Please visit this URL to authorize this application: https://accounts.google.com/o/oauth2/auth?response_type=code&client_id=303402092021-p43bjhs2i3vbf8mhbno6kmml4deqi44k.apps.googleusercontent.com&redirect_uri=http%3A%2F%2Flocalhost%3A34043%2F&scope=https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcalendar.events&state=ozwWQfdV2lDMf5lae9owM37IXY2Wg5&access_type=offline
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30', 'ora_inceput': '9:00', 'ora_final': '10:30'}
Posibila intrebare:  None
```

Click to add text

Then - we give the permission to update the calendar

GOOGLE API #2

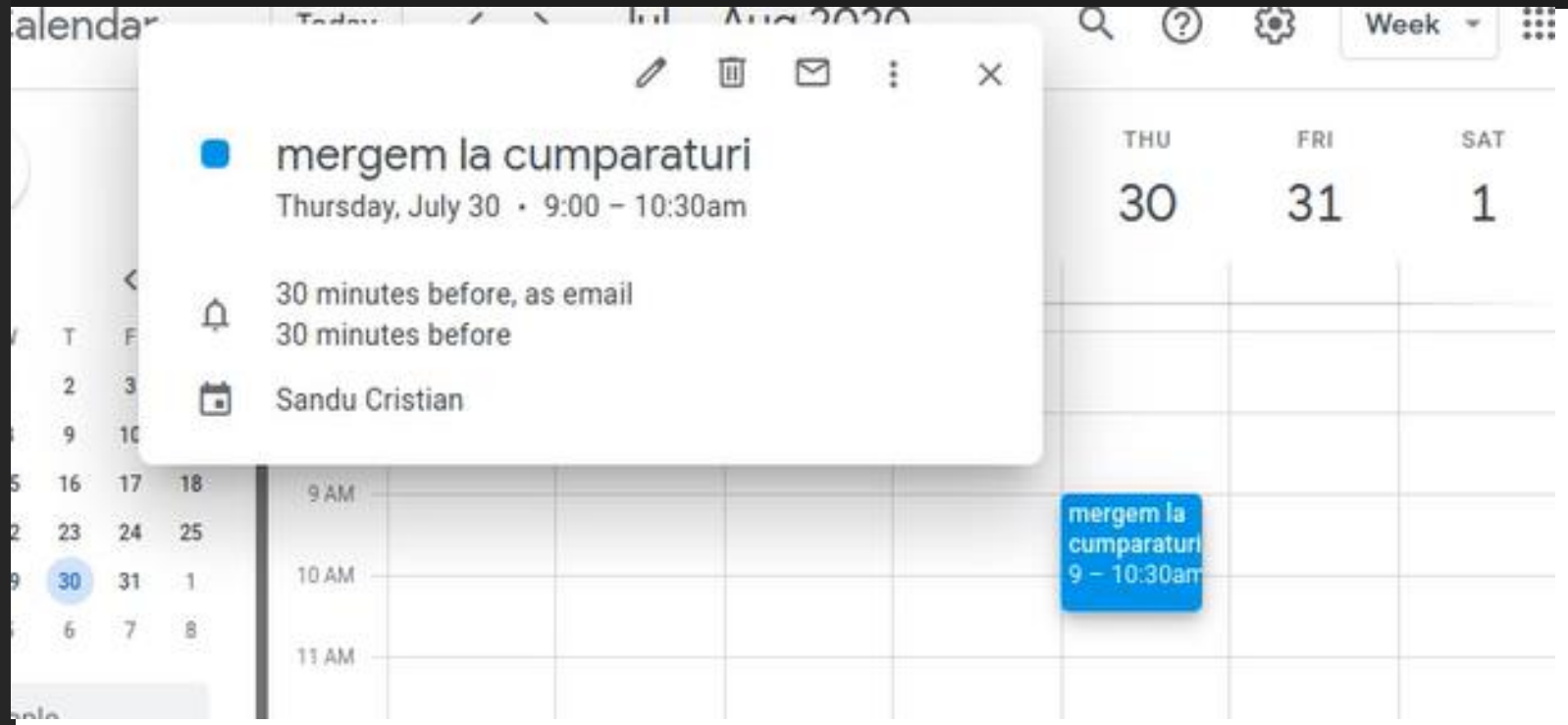
POC for Google calendar API

Working example

```
PROBLEMS 1  OUTPUT  DEBUG CONSOLE  TERMINAL                    1: python3

ubtest@ubTest-Computer:~/NLU_UTCN-master$ python3 main.py
None
Please visit this URL to authorize this application: https://accounts.google.com/o/oauth2/auth?response_type=code&client_id=303402092021-p43bjhs2i3vbf8mhbno6kmml4deqi44k.apps.googleusercontent.com&redirect_uri=http%3A%2F%2Flocalhost%3A34043%2F&scope=https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fcalendar.events&state=ozwWQfdV2lDMf5lae9owM37IXY2Wg5&access_type=offline
Primite:  {'event': 'mergem la cumparaturi', 'data': '2020-07-30', 'ora_inceput': '9:00', 'ora_final': '10:30'}
Posibila intrebare:  None
2020-07-30 9:00 10:30
2020-07-30T9:00:00.000 2020-07-30T10:30:00.000
{'kind': 'calendar#event', 'etag': '"3184481217758000"', 'id': 'a6llggr08m46q1t60dkhim554k', 'status': 'confirmed', 'htmlLink': 'https://www.google.com/calendar/event?eid=YTZsMWdncjA4bTQ2cTF0NjBka2hpbTU1NGsgY3Jpc3RpLnNhbmR1Ljk4QG0', 'created': '2020-06-15T17:03:28.000Z', 'updated': '2020-06-15T17:03:28.879Z', 'summary': 'mergem la cumparaturi', 'creator': {'email': 'cristi.sandu.98@gmail.com', 'self': True}, 'organizer': {'email': 'cristi.sandu.98@gmail.com', 'self': True}, 'start': {'dateTime': '2020-07-30T09:00:00+03:00', 'timeZone': 'Europe/Bucharest'}, 'end': {'dateTime': '2020-07-30T10:30:00+03:00', 'timeZone': 'Europe/Bucharest'}, 'iCalUID': 'a6llggr08m46q1t60dkhim554k@google.com', 'sequence': 0, 'reminders': {'useDefault': True}}
```

Output received from Google API



Our newly added event

Thank you for your time

In color	Achromatic
Break monotony	Starting now, yet soon -
Monotone deafens gracing:	The project ends, but for now
Grow monotonic.	Prolog as haiku.