Appendix 1 – Cezanne.ai[[1]](#footnote-1) open-framework

Summarization

*Sa vorbim despre cezanne challenge*

*La cezzane.ai sa fac la inceput un tablel cu ce baze de date avem nevoie si de unde*

*Sa vorbim daca strangem mechanichal turk pt a strange database sau scenario facute de specialist?*

The research paper had the intention to get a fundamental perspective on how a conversational AI framework could be effective, but in order to put it into practice we are disclosing this open-framework project: Cezanne.ai, in which you can find detailed information. We are not disclosing the actual coding from the beginning as we believe that every developer has tricks that can improve the outcome, but we are opened to share codes and best practices. This project[[2]](#footnote-2) has the objective to build alternatives to current chatbots, operating systems, search engines and programming. If a direct path of communicating with the machine in our natural language is developed (inside a structured conversation) then coding, intermediaries and operating interfaces could become obsolete. Exista principiul ca conversational AI sa fie noul UI

Furthermore, the framework is designed to easily customize conversational bots for different domains/industries and the specificities of different business models. Guidance for language customization is also provided every step of the way.



Chapters/functional specifications:

1. Build a Natural Language Understanding algorithm based on the Pirkin 1&2 models proposed in the research paper
2. Develop algorithms for conversational states and policies based on the Pirkin 3 model from the research paper.
3. Generate bot outputs algorithms based on the Pirkin 4&5&6 models presented in the research paper.
4. Create Cezanne.ai platform for easily adapting/customizing the framework in order to use it in other fields of activities/industry, other cities, or with other databases/ expert knowledge or answers. Books can be directly added and used by Cezanne.ai as knowledge in the conversation.
5. Describe (with roles) how Cezanne.ai framework can be used in a subsequent project:
   * Project plan
   * Open points

Due to our expertise, we are going to make constant referrals to Conversational Bot specialized in restaurant recommendations (but, of course, you can choose whatever domain you want) that is capable to have also deep conversations through books queries and give answers using self-generative policies also (similar to the ones humans are learning/using, AGI).

Implementation of Natural Input Understanding models

The most important model in this project is the NLU/NIU model: Pirkin model that is a contextual model (more similar to a labyrinth network than to a neural network) that is based on fundamentals presented in the research paper.

We will introduce **Commercial topic/intent of the human-to-bot conversation** (with a commercial database assimilated) that will be in our pilot/case study a restaurant recommendation bot (with a database assimilated that will have for example: names of restaurants, locations, chef’s names, type of food…). Everything assimilated with these databases will be considered **core intents** (in our case study the **top intent** will be the restaurant reservations that are the most important objectives of the conversational bot experience and the most important Named Entity Recognition **(NER1)** will be the restaurant’s name). At the same time (besides chitchats) we will have **deep conversational intents** in which the user can conversate with Cezanne.ai on deeper personal or professional topics/intents and will get answers based on **book queries** that cannot be adapted with current models.

In the 4th chapter we will give solutions on how to build a platform that will have restaurants recommendations and custom book queries. If somebody wants to integrate their bot with the platform for other domains (ex: legal, medicine...) they need to make configurations for their targeted domains. Also, cities or books can be customized. For example, in medicine or juridical domain you can add specialized books (laws and treaties) to back up the advisory session. NER1 could be the names of drugs and top intent could be a scheduled visit to a doctor.

Our model will have the capability to do automatic training & labeling or scheduled database updates. It is not recommended to make daily changes in training specific situations. In order to use the framework for different languages/countries, we strongly recommend a fundamental review of your algorithms taking into account the languages specificities (be aware that also the order can have implications and please see comments in the sub-layers related to this topic as we want to guide you through the framework specificities).

* 1. Pirkin 1 model. Machine Education:

*La coduri sa punem: from scratch, adapted,  open source*

*Atentie la datasets si aspectele despre limba generala*

*Sa scoatem vocabularele din datasets, gen Oscar*

* + 1. Auto- Correct

Rasa are si ea un pipeline care poate fi introdus pt spell-check

**Objectives:**

* Inserting diacritics; In Rasa exista Diacritics restauration
* Addressing abbreviations;
* Correcting UNK words with one/two letters deviation.

**Language specificities:** yes (see diacritics)

**Dependencies:** Emoji/Grammar-Semantics

**Database/ Vocabularies needed:** extended Lexicon/ abbreviations/words with diacritics/Roworldnet + Commercial database (in our pilot: types of food, cuisines, names of chefs, names of restaurants, locations) + Books titles/titles of the chapters

**To dos:**

1. A local input processing is needed. Only words in a list are kept for this algorithm.
2. Searching for UNK words in the input corpus.
3. See overlaps between commercial database (priority database) and lexicon.
4. Deploying algorithm for mapping UNK with vocabularies (one & two letters deviations will be addressed) – in that way, if the restaurant’s database words have articles, they will be brought to their base.
5. If in mapping process more than one different vocabulary word will be found, all words will be marked for Grammar/Semantics analysis.
6. Abbreviations will be mapped with Abbreviation's vocabularies and if found will be marked for Emoji algorithm.

**Phyton Code:** We propose existing codes, see code from NLP specialization course (Coursera)- Module 2, Week 1 + Github (horiacristescu) for Romanian diacritics.

* + 1. Input Processing I

**Objectives:**

* Removing hyphens by separating into 2 words;
* Removing words/ characters not needed;
* Addressing numerical data, punctuation, emoji;

**Language specificities:** yes (see hyphens);

**Dependencies:** DER/CVM/EER/Grammar-Semantics;

**Database/ Vocabularies needed:** extended Lexicon/numerical data vocabulary/Emoji/ Rowordnet;

**To dos:**

1. Hyphens are replaced with spaces and both words are completed with a missing character. All words/characters are separated and included into a list.
2. All numerical characters found (including in a special vocabulary) are marked for DER.
3. Emoji are marked and sent to EER.
4. Mark nonexistent vocabulary words with UNK.
5. Mark words that exist more than once in vocabularies for Grammar/Semantics analysis.
6. Remove personal names, telephone numbers, visual inputs, links, other characters like $#@ and the related words.

**Phyton Code:** see code NLP specialization course – Module 1 Week1(LABI), M1W2 (program), M2W3 (prog), M2-W4 (LAB1).

* + 1. Composedwords

**Objectives:**

* Identifying composed words that can be treated as a single word;
* Identifying composed words that need to be addressed separately;
* Identifying adverbs & superlatives of specific adjectives and include them in categories;

**Language specificities:** yes (see expressions and ironies that are specific to each language);

**Dependencies:** Grammar-Semantics/Untrained NIU/ DER/ SPCA/ Embeddings/ Back up algorithm/ Reaction analysis/NER;

**Database/ Vocabularies needed:** extended Lexicon/Dictionaries for expressions, ironies, quotes, metaphors/Database for adverbs & superlatives for specific adjectives/ Roworldnet/ Commercial Database + Books titles/ chapter titles– for the items composed of min 2 words.

**To dos:**

1. Replace definitions found in the user’s intent with the corresponding word.
2. Find specific composed words in commercial database + books/chapter titles database and mark them for NER.
3. Find expressions, metaphors, quotes and mark them for Untrained NIU. Remove them from main model.
4. Find ironies and mark them for Reaction analysis. Remove them from main model.
5. Find adverbs and include them in 5 categories: how often, when, how, how much and where. First 4 categories are marked for DER, the fifth in SPCA.
6. Specific adjectives and their superlatives are included in 5 categories: plus-positive, positive, neutral, negative, minus-negative; in scope of Embeddings and DER relatively vector.

**Phyton code:** B-RNN, NMT, see also M5-W3 (program) in Deep Learning Specialization or M4-W1(program) in NLP specialization.

* + 1. NER

**Objectives:**

* Determining if the input is a core intent or not. Make NER classification and GDPR clean ups;

**Language specificities:** no;

**Dependencies:** SPCA/embeddings/ triggering words;

**Database/ Vocabularies needed**: Commercial database that has a generalities database /Books databases;

**To dos:**

1. Identify commercial NER by importance and classify them accordingly: NER1, NER2, NER3…. The same with books NER: NER01/NER02…. Additional NERs will be mapped through integration with existing slots available.
2. If we have other upper case words inside the sentences that doesn’t appear in the database it will be eliminated for GDPR reasons.
3. Identifications of the domains/industry based on the NER identifications. If NER from more domains/industries are identified then the first counts for the domain identification.
4. If NER 1/NER1.0 is identified, then it will be marked as Subject. If we have NERs from the same domains then the prioritization counts and the 2nd,…NER will be marked as complements. If deep conversational intents do not have NERs, and the subject is CVM, 3rd row.

**Phyton code:** new/see NER algorithms from NLP courses + Built-in Slots – AWS analyze integration/database usage

* + 1. Emoji/Abbreviations (EER)

**Objectives:**

* Gathering the emoji/abbreviations from auto-correct and processing and mark them for Untrained NIU/Reactions;

**Language specificities:** no;

**Dependencies:** Auto-correct /Processing I/Untrained NIU/ Reaction analysis;

**Database/ Vocabularies needed**: database from bucurieesti.ro;

**To dos:**

1. Mark sentences with emoji/abbreviations for Untrained answers.
2. Classify all the emoji/abbreviation in 6 categories (sad, blink, kiss, smile, cool, laughing out loud).
3. Sad and Smile will be send to Reaction analysis sub-layer.
4. The rest will be send to Untrained NIU.

**Phyton code:** See Deep Learning specialization - M5-W2 (program).

* + 1. Grammar/Semantics

**Objectives:**

* Addressing words that are coming from hyphens processing;
* Retrieving information for CVM (verbs);
* Addressing UNK words by finding their POS probabilities;
* Addressing words that has more than one POS in lexicons/vocabularies and estimate their right POS;

**Language specificities:** yes (first 2 objectives);

**Dependencies:** Input Processing l/CVM/ Composed words;

**Database/ Vocabularies needed:** extended lexicon, verbs conjugations/forms, short forms of pronouns, database for POS training/ Commercial Database + Books database (that contains titles/first phrases for each chapter/sub title/ dialogues);

**To dos:**

1. Sent to CVM the data retrieved per each verb (attention: hyphens).
2. Bring words that are coming from hyphens processing to their common base.
3. Train database for semantic (some nouns are marked in composed words for this task).
4. For every word make a tuple of the word and his POS.

**Phyton code:** for UNK: M2 - W3, tokenization: M4-W1, M1-W2 (prog), Semantics: N-Grams M2-W3 or Bi-RNN or NMT (M4-W1) or Bi-LSTM - contextual embedding layer. Tagging: M2-W3, Romanian Academy Al/site/paper.

* + 1. DER

**Objectives:**

* Making a vector with dates, holydays referrals and “when" adverbs are included;
* Making a budget vector;
* Making a number/hour vector;
* Making a relatively vector with adverbs (how often, how, how much) and specific adjectives;

**Language specificities:** no;

**Dependencies:** Input processing l/Composed words/CPL/NOG;

**Database/ Vocabularies needed:** DER are imported from Input Processing I & Composed word;

**To dos:**

1. Asses dates, holydays, ‘when’ adverbs and transform them into a custom date that is included in the date vector;
2. Asses numbers & hours and transform them into a custom number included in the number/hour vector (using available slots).
3. Asses budgets and transform them in budget vector (using available slots).
4. Asses “how often, how, how much" adverbs and specific adjectives from Composed words and transform them into a relatively number that is kept in the relatively vector.
5. Actualize DER only if new specific data is provided (new or actualized) or we have a complete/trained SPCA; if not DER remains the same for the next turns.

**Phyton code:** existing algorithms that transform into custom dates/existing bucurieesti code + built-in slots (see AWS).

* + 1. Splitting sentences

SentencePiece as a tokenizer effective also for this kind of objectives and sentence recognizer from Spacy can be a solution

**Objectives:**

* Splitting the input in sentences;
* Identifying consecutive words with the same POS (except verbs) that are separated by space, "or”, “and”, “comma“;

**Language specificities:** yes, for choosing which consecutive POS to use in the main model;

**Dependencies:** Grammar-Semantics/Input Processing II & Embeddings;

**Database/ Vocabularies needed:** important verbs;

**To dos:**

1. When the following punctuation is identified, separate in different sentences: “.”,”:”,”(“,”!”,”?”.
2. If 2 verbs are consecutive, we keep the one in the database "important verb” or the second one. The other is eliminated.
3. If the POSs are consecutive or separated by space, "or” “and” “comma” we will keep the first word in the string and the others will be sent to Input Processing 2 & Embeddings.
4. The sentence before “but” is eliminated.

**Phyton code:** see M2-W3 (program).

* + 1. CVM

**Objectives:**

Populating a 3\*3 matrix with 1 or 0 for the following:

■ Question/Request or not, Negation or not, Affirmation or not;

■ Future, present or past;

■ First, second or third person of the verb.

Each sentence will have a CVM, if the sum of row 1>1 (priority: negation & question), if sum=0 than affirmation=1.

**Language Specificities:** yes (specific forms of negations, retrieving questions even if “?” doesn't exist);

**Dependencies:** Grammar-Semantics/Splitting sentences/CPL

**Database/ Vocabularies needed:** key words for negations/affirmations/questions

**To dos:**

1. Retrieve info from Grammar-Semantics and populate the 2nd and 3rd row of the CVM.
2. Search each sentence for key words for negation (Romanian forms: n- included, or: deloc/proasta/exclus/niciodata ).
3. Searching for wording/punctuation for questions. Verb before pronoun or sentence starting with When, Where... or I want, need... = questions

**Phyton code:** new.

* + 1. IVM

**Objectives:**

Populating a matrix with the following information:

■ Number of conversational turns, and what the bot is receiving each turn;

■ The bot can receive the following: SPCA (5 types of SPCA presented in the specific sub-layer), reactions, chitchats or back-up inputs;

■ No. of short sentences, no. of complex sentences, no. of inputs from EER & Composed word.

**Dependencies:** EER/Composed word /Splitting sentences;

**To dos:**

Column 1. The number of the turn. Multiple inputs w/t a response from the bot is considered as 1.

Column 2. SPCA1 inputs (0 if non; 1.1,1.2 for the type of SPCA1, see specific sub layer).

Column 3. Reactions (0 for non; 1-9 for the type of reactions - see specific sublayer: Reaction analysis).

Column 4. Chitchats&SPCA3 (0 for non, 1-10 for specific chitchats, 9.1-9.4 the sub-categories for feedback and 10.1-1.7 sub-categories for elaborate),

Column 5. SPCA4 inputs (0 if non; 1,2,3 for the type of SPCA4, see specific sub layer).

Column 6. Short sentences. A sentence with 1 verb is classified as short. Count the number of sentences with 1 verb.

Column 7. Complex sentences. A sentence with more than 1 verb (the verbs that are marked for SPCA multiplication also counts).

Column 8. No. of inputs from EER & Composed words.

Column 9. back-up inputs (0 if non; 1.1,1.2 - see specific sub-layer).

**Phyton code:** new.

* + 1. AVM

**Objectives:**

Populating a matrix with the following information:

■ Number of conversational turns, and what the bot is answering each turn;

■ Type of bot answers: NOG (NOG 1,2,3, 5 presented in the specific sub-layer), secondary answer. “I do not know" answer;

■ Type of bot questions/actions: additional, confirmation, review, change topic, disclaimer;

■ 3rd flow empathetic interactions and bot queries;

■ History of the answers/questions/empathy - not to risk repeating;

**Dependencies:** NOG/IVM

**To dos:**

Column 1. The number of the turn needs to be correlated with IVM.

Column 2. Answers (0 if non: 1,2,3,5 for the type of NOG (+core/deep/back up criterias), 7 for secondary and 8 for “I do not know” )

Column 3. Answer identification number - each answer will have a code.

Column 4. Questions/Actions (0 for non, 1 for additional, 2 for confirmation, 3 for review, 4 for change topic, 5 for disclaimer)

Column 5. Questions/Actions Identification number - each bot action/question will have a code.

Column 6. 3rd flow empathetic interactions and bot queries.

Column 7. 3rd flow identification number and bot queries - not to repeat the empathy.

**Phyton code:** new

* 1. Pirkin 2 model. Machine/Deep Learning.
     1. Reply

1.Sa dam info detaliate despe dataset si frameworks used. Folosim un back-up model?

2. pre-training social media; fine-tunning generative models – BST?

3. sa tinem cont de ce am scris in lucrare

**Objectives:**

* Evaluating the replies of the users’ utterance in a short sentence;
* The replies can be in a standalone input, or together with other types of inputs (intents/conversational…);

**Language specificities:** no;

**Dependencies:** Splitting sentences/ Reaction analysis;

**Database/ Vocabularies needed:** 3 databases with 3 types of replies: confirmations / satisfactions/ understanding, divided equally between positive and negative and with 80-20 training vs testing.

**To dos:**

1. Apply sentiment analysis algorithms on every short sentence to see if the user is giving the bot any replies (3 types).
2. Classify the replies in 6 categories (understanding, misunderstanding, confirmation, negation, satisfied, unsatisfied) and send them to Reaction analysis sub-layer.
3. Eliminating the sentence from Pirkin Model if a valid reply is identified. This sentence (in the case the input has more sentences) will be evaluated for conversational purposes/NIU.

**Phyton code:** first we will use a classification or a probabilistic model (NLP specialization course M1&2 , W1) to see the results on our limited database. If it is a need for a more complex model (sequence or attention for example) we will use it, but as we are only making sentiment analysis on short sentences it probably wouldn't be necessary for something too complex.

* + 1. Chitchat

1.Sa dam info detaliate despe dataset si frameworks used. Folosim un back-up model?

2. pre-training social media; fine-tunning generative models – BST?

3. sa tinem cont de ce am scris in lucrare

**Objectives:**

* Evaluating the chitchat of the users utterance in short sentences;
* Chitchats can be in a standalone input, or together with other types of inputs (intents/replies...);
* The bot answers will be given in the secondary flow (first displayed answer), and the bot can give a main answer in the same time (second displayed answer);

**Language specificities:** no;

**Dependencies:** CPL/Splitting sentences;

**Database/ Vocabularies needed:** databases with chitchats split in 10 categories (including feedback with 4 sub-categories and elaboration database that is specific for queries with 7 subcategories – see Labyrinth model).

**To dos:**

1. Analyze CPL and splitting sentences.
2. Assess CVM of the Chitchat sentence that will be used in CPL for Diatribe.
3. Apply transformers algorithms (E2E model, including embeddings) on every short sentence to see if the user is giving the bot any chitchats found in the database (labeling).
4. Updating IVM/AVM depending upon which of the 10 databases was used to give an answer.
5. Eliminating the sentence from Pirkin Model if a valid chitchat is identified.

**Phyton code:** transformers; NLP specialization - M4-W4

* + 1. Untrained NIU

**Objectives:**

* Giving answers to specific interactions that cannot be trained;
* The bot answers will be given in the secondary flow (first displayed answer), and the bot can give a main answer at the same time (second displayed answer);

**Language specificities:** yes;

**Dependencies:** Chitchat/EER/Composed word;

**Database/ Vocabularies needed:** database with specific answers (some random also for expressions);

**To dos:**

1. Receiving inputs from Composed word and Emoji/Abbreviation (these were already categorized).
2. Recategorized composed words that transmit a specific reaction (confirmation/satisfaction/understanding) and send this to reaction analysis.
3. Apply mapping only if no other chitchat valid answer was given. Only one answer is given based on LIFO Updating AVM.
4. Eliminating inputs.

**Phyton code:** new (mapping).

* + 1. Input Processing II

**Objectives:**

* Cleaning up words that were used for other purposes;
* Preparing for Embeddings;

**Dependencies:** Splitting sentences/DER/CVM;

**Database/ Vocabularies needed:** extended Lexicon, vocabularies for verbs (conjugation forms);

**To dos:**

1. Remove numerical data, punctuation, uppercase and other words used in scope of CVM and DER;
2. Stem words and/or bring words to their base (for ex: verbs are transformed to their infinitive form), including words that are marked in Splitting sentences

**Phyton Code:** stemming: M1-W1 (LAB) + M1-W2 (program); M2-W3: M2-W4 (LAB)

* + 1. Database processing

**Objectives:**

* Creating vocabulary with word frequencies for each database;
* Analyzing word POSs in inputs vs in databases;

**Dependencies:** Input processing I & II / Composed words/ Grammar Semantics;

**Database/ Vocabularies needed:** Database with chitchats (split in 10)/replies (split in 3) bucurieesti.ro + Commercial database

**To dos:**

1. Each database is processed in the same way the input is processed, without the creation of entities and matrices.
2. 4 steps in processing and the order: Input processing I, Composed words, Grammar-Semantics, Input processing II.
3. After processing, apply word frequencies (depending on the POS) and create vocabularies for each database.
4. Assign NER1,NER2…NER01/NER02 + determine commercial domain.

**Phyton code:** M3-W4 (data generator + M2-W1 (LAB 1 for vocabulary) + algorithms used in the sub-layers Input processing I & II / Composed words/ Grammar Semantics.

* + 1. Books processing

**Objectives:**

* Creating vocabulary with word frequencies for each books;
* Transforming the content of the books into a structured database that can be trained;

**Dependencies:** NOG from books/Embeddings/ CVM/ Grammar/ Auto-correct;

**Database/ Vocabularies needed:** Books;

**To dos:**

1. All books will be divided in chapters/sub-chapters/paragraphs/sentences, maintaining in the same time their initial place by using a special origin notation for NOG chronological correlations.
2. Apply Machine Education on every sentence (Grammar, NER and CVM).
3. Delete paragraphs with NERs for novels and scripts.
4. CVM matrix will be computed for each sentence. If a paragraph has more sentences, the CVM of the last sentence will be considered the one corresponding to the paragraph.
5. All bold paragraphs, chapters and sub-chapters names will be considered Book Intent Database (BID), together with all paragraphs that are considered questions by CVM matrix.
6. All the CVMs affirmations and negations will be marked for the Book Output Database (BOD) keeping chronology.
7. All the paragraphs in the BOD will be split in 9 for CVM’s possibilities (row 2 and 3) – persons and tenses.
8. Apply the same processes from Database processing for Book Intent Database.

**Phyton code:** M3-W4 (data generator + M2-W1 (LAB 1 for vocabulary) + algorithms used in the sub-layers Input processing I & II / Composed words/ Grammar Semantics.

* + 1. Auto-Complete

Sa folosim BERT-masking pt cele 4 task-uri din paper

**Objectives:**

* Using database to auto-complete UNK words in the input (we will not use books);
* Using auto-complete in case a verb, an adjective or a noun is missing, and at the same time IVM/AVM indicates that there are no past intents interactions, in order to find the most probable words in the database, so as to complete the user input with implicit words.

**Dependencies:** IVM/AVM/Input Processing II;

**Database/ Vocabularies needed:** Database with chitchats/replies bucurieesti.ro + Commercial Database with recommendation;

**To dos:**

Step 1. Search for UNK words. If found, skip step 2. In case of more UNK words, mark the last one.

Step 2. If we don’t have past intents from the user, search if we have all this three POSs in the intent in this order: verb, noun, adjective. Mark the POS (only one) that doesn't exist.

Step 3. Auto-complete the marked position/UNK word using the limited databases.

\* Attention to the NER(ex: we will not do auto-complete for NER)

**Phyton code:** M3-W1 in the NLP specialization and a Ngrams algorithm if we have computational issues and the results are acceptable.

* + 1. Embeddings

**Objectives:**

* Analyzing words that are used to empower other words;
* Finding the most familiar word (for example a synonym to the word from the user that is more known) - we include here also words that are coming from Splitting sentences and composed words;
* Making a word embedding vector to cover all 4 dimensions of the word;

**Language specificities:** yes for words connectors (ex: ''at", “in”) and specific forms of the verbs (ex: “will be", “would”);

**Dependencies:** Splitting sentences/Composed words/ Input processing ll/Database processing/Books processing;

**Database/ Vocabularies needed:** vocabularies for synonyms, regional words, neologisms: vocabulary with connectors;

**To dos:**

1. Asses the syntactic functions of words using connectors words (ex : "at”, “in”) + other types (like “will be”) + negations; then eliminate these words.
2. Built a matrix (we will name it k-word) that has on the first column the following:
   * Index no. of the word in the lexicon/commercial database/additional index for the composed words;
   * Domain identification;
   * NER identification – will be regarded as slot types in training;
   * The POS of the word;
   * Frequency of the word in the database/books 1& 2& 3 (ex: database for chitchat). NER will not have frequencies.
3. Include in the k-word additional columns: synonyms/ neologisms, regional words and words from splitting sentences.
4. The column with the highest frequency or with a slot type will become the k-word vector of the word.
5. Build the embedding vector of the word with the following data range between -3 and 3: frequency in the database 1/2/3, frequency of the word in the intent (if the words repeat in the same intent/input), position of the word inside the intent, position of the word vs the verbs/nouns/adjectives, category of the adjectives (from composed words).

**Phyton code:** new

* + 1. Triggering/ Common interest

**Objectives:**

* Assessing K-word (see Embeddings) for each word in the SPCA, especially the frequencies for the core databases (ex: restaurants recommendation);
* Initiating clarification discussions with the user if we have incomplete information, or we don’t have a clear intent;

**Dependencies:** SPCA/ Embeddings/ IVM;

**Database/ Vocabularies needed:**

**To dos:**

Step 1. Verify IVM. Triggering applies only once (mainly for turn 1).

Step 2. See if we have specific k-words for all SPCA. If yes, step 3 is skipped.

Step 3. Address additional questions to the user for details. The question will be specific, by using the word with the highest frequency or the identified NER, or general, if we don't have k-word with high frequency.

**Phyton code:** new/ inhouse

* + 1. Domain validation

**Objectives:**

Verifying the type of SPCA, confronting also with CVM:

1. SPCA1 - or core (for example: restaurant recommendation or legal consultancy...);

2. SPCA2 – back up for replies (3 types depending on the databases: confirmation, satisfaction, understanding);

3. SPCA3 – back up for chitchats (this can be descriptions of a situations or discussions not intended for a conclusion);

4. SPCA4 – deep conversational discussion on a topic through book queries (without a back up);

**Dependencies:** SPCA/ CVM/ Embeddings/ Reply/ Chitchat;

**Database/ Vocabularies needed:** commercial databases (ex: restaurants: foods, chefs …) + Chitchat database (labyrinth model) + Book database;

**To dos:**

Step 1. Verifying all k-words of the sentence, if the user is talking about core domains and which one (restaurant, legal, investment...).

Step 2. If core domain, confronting with CVM and checking the results of sub-layers Reply and Chitchat.

Step 3. If SPCA1, check if P=“top intent/reservation” or S=“NER1/ restaurant list name”. If yes, classified as SPCA1.1 (top intent/reservation) and SPCA1.2 (NER 1).

Step 3. If not core domain, check k-words and CVM to classify as SPCA2, SPCA3 or SPCA4.

Step 4. SPCA2 and SPCA3 will be also classified in SPCA2.1-2.3 and SPCA3.1-3.10 depending on the specific databased used. 3.9 has 4 additional subtypes, 3.10 has 7 additional subtypes. If a secondary flow reply is active, SPCA2 will be eliminated. The same with SPCA3 and chitchats - the secondary flow has priority.

Step 5. SPCA4 will have 3 correspondences in NOG: novels/screenplays or specialized books.

Step 6. If no domain is identified, then we will consider it SPCA0 and w/t a SPCA memory update the bot will not have an answer.

**Phyton code:** new/ inhouse

* + 1. SPCA- memory update

**Objectives:**

* Making an update between present SPCA and past one that went through Reset sub-layer from CPL layer;
* Making rules between present SPCA that can be SPCA1/SPCA3/SPCA4 and past ones with the same possibilities. SPCA2 is not in scope of memory update (it's treated in CPL);

**Dependencies:** NOG/Reset/Domain validation/ IVM/AVM/ CVM;

**Database/ Vocabularies needed:**

**To dos:**

Step 1. Asses if we have past SPCA and its type- Verify Reset sub-layer & IVM & AVM. If not. SPCA final = SPCA & stop other steps.

Step 2. Verify if present SPCA has the same type with past SPCA. If not skip Step 3.

Step 3. Prioritize the present SPCA. The Complement and Attribute can only be updated together (Or NER and Attribute). In case of no predicate in the current SPCA, the CVM final=CVM past (-1). In case of no subject in present SPCA, the final S = past S. The same with the Complement and the Attribute. Exceptions for specific additional questions. After update, the Domain validation sub-layer will be repeated.

Step 4. If the present SPCA and past SPCA are of different types, no update will be made and final SPCA= present SPCA.

Step 5. If present SPCA is SPCA0 and we have past SPCAs, the same rules from Step3 applies.

Phyton code: new/ MRC model - page 34 – Gao

* + 1. Main flow/Back up

**Objectives:**

* Evaluating the intents of the users utterance in a E2E model;
* Using this model as a back up in case the user has negative sentiments about the Pirkin model answers;
* Using also this model if the bot automatically determines that it is more efficient;

**Dependencies:** NOG/AVM/Auto-training/Splitting sentences;

**Database/ Vocabularies needed:** Commercial Database with recommendations;

**To Dos:**

1. Verify if there is a request for a back up answer.
2. Apply transformers algorithms (E2E model, including embeddings) on the user main intent;
3. Determine what kind of back up is used depending on the database (back-up 1 for core, back up 4 for deep conversational through book queries).
4. Back up will have 2 subdomains if it is referring to top intents (Back up 1.1; for example: reservation) or back up 1.2 if it is referring to NER1.
5. Updating IVM/AVM.

**Phyton code:** transformers; NLP specialization - M4-W4.

Implementation of Conversational Policy Learning models

* 1. Reaction analysis

**Objectives:**

* Identifying if the user is having a reaction following the bot actions (by training/labeling the databases in 2 ways: using a DL/E2E model and Pirkin model (SPCA2) similar with chitchats – see the processes in NOG layer);
* If more than one reaction is coming from the current input then the priority is: Ironies, Reply, SPCA2, Emoji, Untrained;
* Actualizing IVM;
* Transforming this reactions in bot actions in the sub-layer: Debate or bot actions from reactions.

|  |  |  |  |
| --- | --- | --- | --- |
| **NIU** | **CVM** | **Positive/Negative reaction** | **Classification/IVM** |
| ironies | n/a | negative | 8.Sarcastic |
| sad face | n/a | negative | 6.Sad |
| Smiley face | n/a | positive | 2. Happy |
| SPCA2/Reply/Untrained - confirmation | affirmation | positive | 3.Confirmation |
| SPCA2/Reply/ Untrained- confirmation | negation | negative | 5.Negation |
| SPCA2/Reply/Untrained - satisfaction | affirmation | positive | 1. Satisfied |
| SPCA2/Reply/Untrained - satisfaction | negation | negative | 9. Unsatisfied |
| SPCA2/Reply/ Untrained- understanding | affirmation | positive | 4. Understanding |
| SPCA2/Reply/ Untrained- understanding | negation | negative | 7. Misunderstanding |

* 1. Reset

Sa acoperim si back-up model asa cum e definit mai nou. Ref si la memory update din lucrare si auto-complete

**Objectives:**

* Resetting previous SPCA depending on AVM and current user reaction;
* Appending/resetting chitchats depending on AVM and current user reaction;
* Appending/resetting back-up answer depending on AVM and current user reaction;
* Resetting DER;
* Freeze means that no SPCA of inputs are updated until the end of the query/action.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NOG/NIU (-1)** | **Pirkin**  **model** | **Pirkin +**  **negative** | **Chitchat**  **only** | **Chitchat +**  **negative** | **Back up** | **Backup +**  **negative** | **DER** |
| **NOG 1** | Reset PCA | Reset SPCA | n/a | n/a | reset | append | No reset |
| **NOG 2** | Reset PCA | Reset SPCA | n/a | n/a | reset | append | No reset |
| **NOG 3** | Reset SPCA | Reset SPCA | reset | append | n/a | n/a | reset |
| **NOG 4** | Reset SPCA | Reset P | n/a | n/a | n/a | n/a | reset |
| **NOG 5** | No reset | Reset CA | n/a | n/a | n/a | n/a | No reset |
| **NOG 6** | Freeze SPCA | Freeze SPCA | n/a | n/a | n/a | n/a | No reset |
| **Additional question** | No reset | No reset | append | n/a | append | n/a | No reset |
| **Confirmation question** | No reset | Reset PCA | n/a | n/a | n/a | n/a | No reset |
| **Change topic** | Reset SPCA | No reset | reset | Append | reset | append | reset |
| **Review request** | No reset | Reset PCA | n/a | n/a | append | reset | No reset |
| **“I do not know”** | Reset PCA | Reset PCA | reset | Append | append | append | No reset |
| **Disclaimer/ no action** | Freeze SPCA | No Reset | n/a | n/a | append | reset | No reset |

* 1. States

**Objectives:**

* Assessing the current state of the conversation;
* Additional/Confirmation questions are not influencing the states;
* In the current NIU we have main flow and secondary flow, the state is influenced only by the main flow, but Dialogues & Discourses will initiate a secondary flow (Diatribe) if the case;
* Queries states (as past states) will be treated differently in sub-layers because of their specificities.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Current NIU/past states** | **N/A** | **Discourse** | **Dialogue** | **Diatribe** | **Debate** |
| **SPCA 0/back up 0** | IDNK (+Diatribe) | Discourse 0 (+Diatribe) | Dialogue 0 (+Diatribe) | Diatribe | Debate (+Diatribe) |
| **DER – relatively vector =10-90%** | Bot queries 2 | Bot queries 2 | Bot queries 2 | Bot queries 2 | Bot queries 2 |
| **SPCA1.0 short / back-up 1** | Dialogue 1(+Diatribe) | Dialogue 2 (+Diatribe) | Dialogue 2 (+Diatribe) | Dialogue 1 | Dialogue 1 (+Diatribe) |
| **SPCA 1.0 - complex** | Discourse 1 (+Diatribe) | Discourse 2 (+Diatribe) | Discourse 2 (+Diatribe) | Discourse 1 | Discourse 1 (+Diatribe) |
| **SPCA 1.1/back up 1.1 or DER (dates, number, hour)** | Bot Queries 1 | Bot Queries 1 | Bot Queries 1 | Bot Queries 1 | Bot Queries 1 |
| **SPCA 1.2/back up 1.2** | Dialogue 1 | User queries 1 | User queries 1 | Dialogue 1 | User queries 1 |
| **Only Reaction(SPCA2/Reply)** | Debate (+Diatribe) | Debate (+Diatribe) | Debate (+Diatribe) | Debate | Debate (+Diatribe) |
| **SPCA 3/Chitchat (w/t feedback/elaborate)** | Diatribe | Diatribe | Dialogue | Change topic 1 | Diatribe |
| **Chitchat (feedback/elaborate)** | Diatribe | User queries 1/2 | User queries ½ | Diatribe | Diatribe |
| **SPCA 4 short** | Dialogue 1 (+Diatribe) | User queries 2 | User queries 2 | Dialogue 1 | Dialogue 2 (+Diatribe) |
| **SPCA 4 complex** | Discourse 1 (+Diatribe) | User queries 2 | User queries 2 | Discourse 1 | Discourse 2 (+Diatribe) |

* 1. Discourse

**Objectives:**

* Applying policies depending on the evaluation of CVM and the type of the state;
* If more policies apply at the same time, the priority is: answer/review/confirmation/change topic/Disclaimer/”l do not know”
* Check if the state is accurate. If not, reclassify the state Review 1 purpose is to memorize current input.

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| **CVM/Type of Discourse** | **CVM 3rd row** | **Discourse 0** | | | **Discourse 1** | | | **Discourse 2** | | |
| **CVM-first row** | **person** | **Affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** |
| **CVM past** | i | Additional 3 | no action | IDNK | review1 | Debate 1 | IDNK | confirmation | Debate 1 | No action |
| ii | Additional 3 | Debate 1 | Additional 3 | confirmation | Debate 1 | NOG1 | NOG1 | Debate 1 | NOG1 |
| iii | no action | no action | IDNK | confirmation | Review1 | confirmation | review | Debate 1 | NOG1 |
| **CVM- present** | i | Additional 3 | Debate 2 | IDNK | review1 | Debate 2 | review1 | NOG1 | review1 | confirmation |
| ii | Additional 3 | Debate 2 | dialogue 0 | NOG1 | Debate 2 | NOG1 | NOG1 | Debate 2 | NOG1 |
| iii | Additional 3 | debate 2 | IDNK | confirmation | No action | confirmation | NOG1 | Debate 2 | NOG1 |
| **CVM- future** | i | Additional 3 | debate 3 | IDNK | confirmation | review1 | NOG1 | NOG1 | review1 | NOG1 |
| ii | Additional 3 | Debate 3 | Additional 3 | NOG1 | Debate 3 | NOG1 | NOG1 | Debate 3 | NOG1 |
| iii | Additional 3 | Debate 3 | Additional 3 | confirmation | Debate 3 | confirmation | NOG1 | Debate 3 | NOG1 |

* 1. Dialogue

**Objectives:**

* Applying policies depending on the evaluation of CVM and the type of the state;
* If more policies apply at the same time, the priority is: answer/review/confirmation/change topic/Disclaimer/ “l do not know”
  + - Check if the state is accurate. If not, reclassify the state
    - Review 2 is for asking the future reviews

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CVM/Type of Dialogue** | **CVM 3rd row** | **Discourse 0** | | | **Discourse 1** | | | **Discourse 2** | | |
| **CVM-first row** | **person** | **affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** |
| **CVM - past** | I | IDNK | no action | IDNK | review2 | debate 1 | NOG2 | review2 | Debate 1 | NOG2 |
| II | IDNK | Debate 1 | NOG2 | NOG2 | Debate 1 | NOG2 | NOG2 | Debate 1 | NOG2 |
| III | no action | no action | IDNK | NOG2 | review2 | NOG2 | review2 | Debate 1 | NOG2 |
| **CVM- present** | I | IDNK | Debate 2 | IDNK | review2 | Debate 2 | NOG2 | NOG2 | review2 | NOG2 |
| II | IDNK | Debate 2 | NOG2 | NOG2 | Debate 2 | NOG2 | NOG2 | Debate 2 | NOG2 |
| III | IDNK | debate 2 | IDNK | NOG2 | No action | NOG2 | NOG2 | Debate 2 | NOG2 |
| **CVM- future** | I | IDNK | Debate 3 | IDNK | NOG2 | review2 | NOG2 | NOG2 | review2 | NOG2 |
| II | IDNK | Debate 3 | NOG2 | NOG2 | Debate 3 | NOG2 | NOG2 | Debate 3 | NOG2 |
| III | IDNK | Debate 3 | No action | NOG2 | Debate 3 | NOG2 | NOG2 | Debate 3 | NOG2 |

* 1. Diatribe

**Objectives:**

* Re-assessing the intention of the user to make sure we had an accurate understanding

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of Diatribe/ CVM 2nd row** | **CVM past** | | | **CVM present** | | | **CVM future** | | |
| **CVM - first row** | **affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** | **affirmative** | **negative** | **question** |
| **What you are doing?** | No action | Debate 1 | NOG3 | No action | Debate 2 | NOG3 | No action | Debate 3 | NOG3 |
| **Who are you** | NOG3 | Debate 1 | NOG3 | NOG3 | Debate 2 | NOG3 | NOG3 | Debate 3 | NOG3 |
| **Personality** | NOG3 | Debate 1 | NOG3 | NOG3 | Debate 2 | NOG3 | NOG3 | Debate 3 | NOG3 |
| **Greetings** | NOG3 | | | | | | | | |
| **BFF** | NOG3 | Debate 1 | Debate 2 | NOG3 | Debate 2 | NOG3 | NOG3 | Debate 3 | NOG3 |
| **Specific info's** | No action | Debate 1 | NOG3 | No action | Debate 2 | NOG3 | NOG3 | Debate 3 | NOG3 |
| **General info's** | No action | Debate 1 | NOG3 | No action | Debate 2 | NOG3 | NOG3 | Debate 3 | NOG3 |
| **Redirect** | Debate 3 | Debate 1 | Review 2 | Review 2 | Debate 2 | Review 2 | Review 2 | Debate 3 | Review 2 |
| **Feedback (4 types)** | NOG3 + NOG5 (if user queries is active) | | | | | | | | |
| **Elaborate (7 types)** | NOG3+NOG5 | Debate 1 | No action | NOG3+NOG5 | Debate 2 | NOG3+NOG5 | No action | Debate 3 | NOG3+NOG5 |

* 1. Debate from other states

**Objectives:**

* Choosing the right policies when debate is initiated in the following states due to CVM assessment:
  + - * Discourse;
      * Dialogue;
      * Diatribe.

|  |  |
| --- | --- |
| **Debates initiated** | **Policies – 3rd flow – NOG 4** |
| Debate 1 (CVM - past) | Responding to bad news |
| Debate 2 (CVM - present) | Showing surprise |
| Debate 3 (CVM - future) | Getting the user to say more |

* 1. Debate or bot actions due to reactions

**Objectives:**

* If an input with reaction has also a secondary flow, the secondary flow will be addressed together with 3rd flow;
* Applying empathic actions/policies (3rd flow, with red) depending on the reactions of the user and the type of the state;
* If Backup answer (see conversational analysis, in some instances the back-up answer can be the answer from SPCA/Pirkin model and not from the back-up model) was already provided or doesn’t exist, then policies from the Secondary flow/NOG3 apply;
* If the current input has also intents, then the 3rd flow will not be initiated.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **User reactions/**  **bot action** | **Additional questions** | **Confirmation questions** | **Review/ Opinion 1** | **Review/ opinion 2** | **Disclaimers w/t IDNK** | **IDNK** | **Change topic** | **3rd flow/**  **bot queries** | **NOG 1/2/5** | **NOG 3** |
| **No reactions** | NOG1 | NOG1 | No action | Ch.Topic 2 | No action | Ch.Topic2 | No action | No action | Ch.topic2 | CH.Topic1 |
| **Understanding** | No action | NOG1 | Sp.policy1 | Sp.policy2 | No action | Backup NOG | Own story | Say more | Agreement | Good news |
| **Confirmation** | No action | NOG1 | Sp.policy1 | Sp.policy2 | No action | Backup NOG | Say more | Say more | Good news | Agreement |
| **Satisfied** | NOG1 | NOG1 | No action | Sp.policy2 | No action | Backup NOG | Good news | Say more | Agreement | Good news |
| **Happy** | NOG1 | NOG1 | No action | No action | No action | Backup NOG | Agreement | Say more | Good news | Good news |
| **Misunderstanding** | NOG1 | Own story | Own story | Own story | Surprised | Backup NOG | Own story | No action | Backup | Bad news |
| **Negation** | NOG1 | Backup NOG1 | Ch.Topic 2 | Ch.Topic 2 | Surprised | Backup NOG | Bad News | No action | Backup | Say more |
| **Unsatisfied** | Say more | Backup NOG1 | Ch.topic 2 | Bad news | Surprised | Backup NOG | Say more | No action | Backup | Own Story |
| **Sarcastic** | surprised | Backup NOG1 | Ch.topic 2 | Say more | Surprised | Backup NOG | Surprise | No action | Backup | Surprise |
| **Sad** | NOG1 | Backup NOG1 | Ch.topic2 | Say more | Surprised | Backup NOG | Say more | No action | Backup | Say more |

* 1. User queries

**Objectives:**

* Which policies apply depending on the current NIU?
* In which conditions the user queries state initiate other states?
* If DER- relatively vector is between 10 and 90% then Bot queries 2 is initiated.

|  |  |  |
| --- | --- | --- |
| **Current NIU/past states** | **User queries 1/**  **initiation from other states** | **User queries 2/**  **Initiation from other states** |
| **SPCA 0/back up 0** | Additional question 4 | Additional question 5 |
| **SPCA1.0 short / back-up 1** | NOG 5 (Commercial bot) | Dialogue 1 |
| **SPCA 1.0 - complex** | NOG 5 (Commercial bot) | Dialogue 1 |
| **SPCA 1.1/back up 1.1** | Bot queries 1 | Bot queries 1 |
| **SPCA 1.2/back up 1.2** | NOG5 – if same restaurant or dialogue | Dialogue 1 |
| **Reaction(SPCA2/Reply) w/t the ones caused by bot questions** | Exit situations | Exit situations |
| **SPCA 3/**  **Chitchat (w/t feedback & elaborate)/ Untrained** | Change topic 1 | Change topic 3 |
| **SPCA 4** | Change topic 1 | NOG 5 (Labyrinth model) |
| **Chitchat (feedback + elaborate)** | N/A | NOG 5 (Labyrinth model) |

|  |  |  |
| --- | --- | --- |
| **Exit situations** | **User queries 1** | **User queries 2** |
| **Misunderstanding** | Exit/debate | Exit/debate |
| **Negation** | Exit/debate | No exit |
| **Unsatisfied** | Dialogue | Dialogue |
| **Sarcastic** | Exit/debate | No exit |
| **Sad** | Exit/debate | No exit |
| **Understanding** | No exit | No exit |
| **Confirmation** | No exit | No exit |
| **Satisfied** | Exit/Debate | No exit |
| **Happy** | No exit | No exit |

* 1. Labyrinth model (AGI)

|  |  |  |
| --- | --- | --- |
| **Situations inside user queries** | **Identification of the situation** | **NOG/Solution** |
| User doubts | Chitchat- feedback/+ current SPCA4 | NOG5 next + disclaimer 1 + negative feedback |
| User interest in writer opinion | Chitchat- feedback/ + current SPCA4 | NOG5 next + positive feedback |
| User interest in the writer | Chitchat- feedback/ + current SPCA4 | NOG5- writer presentation + positive feedback |
| The user is sharing his thoughts | Chitchat- feedback/ + current SPCA4 | NOG5 next + positive feedback |
| Bot intuition | DER – relatively vector = [10%-90%] | NOG6 - Bot queries 2 |
| Expositions | Chitchat elaborate | NOG5- beginning of the chapter reproduction |
| Plot | Chitchat elaborate | NOG5 – next phrase/section after beginning |
| Core action | Chitchat elaborate | NOG5 – the next section after the plot |
| Highlight | Chitchat elaborate | NOG5 – summarization – SPCA |
| Outcome | Chitchat elaborate | NOG5– last section of the chapter |
| Go back to the main topic | Chitchat elaborate | NOG5 – book introduction |
| Different approaches | Chitchat elaborate | NOG5- second answer as frequency |
| Change in topic | SPCA4 - new | Disclaimer 2 for changing chapter + NOG5 begin. |
| Bot initiatives | Positive reaction or no possible answers | Disclaimer 3 – promoting the book |

**Phyton code:** new;

* 1. Bot queries (Prompts - AGI)

**Objectives:**

* + When to exit the bot queries?
  + What policies to apply in different circumstances?
  + Things are more straight forward for Bot queries 1 and we don’t need supplementary analyses.
  + The initial intent is addressed only after DER becomes more than 90%.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Policy/DER relatively vector** | **DER<10%** | **DER=[10-29%]** | **DER =[30-49%]** | **DER =[50-69%]** | **DER =[70-89%]** | **DER>=90%** |
| Intuition policies | No policy | Share his thoughts | Interest in the user opinion | Interest in the user person | Doubts | No policy |

**Exit Bot queries 2**:

* DER relatively vector<10% or >90%;
* No DER relatively vector in the last 2 turns;
* New inputs: SPCA1;
* Repetitive types of SPCA’s or back up’s (ex: his asking 2 times for redirect);
* Reactions: sarcastic, misunderstanding, unsatisfied;

**Exit Bot queries 1:**

* All cases except SPCA1.2/1.1 and DER actualization,
  1. Special policies

**Objectives:**

* + Applying no action policy in defined cases, initiated either by other states, either by this state;
  + Applying a policy for instances when the user is not giving any reaction to the bot actions (answers/questions…);
  + Capturing reviews/opinions offered actively by the user (after positive reaction from the user);
  + Capturing reviews/opinions solicitated by the bot (conditioned by the offering or the positive reaction);

|  |  |  |  |
| --- | --- | --- | --- |
| **Policies** | **States originated** | **NIU implications** | **To dos** |
| No action | All States | Freeze NIU | The bot will not have any actions |
| No reaction | NOG - all | Freeze NIU | Wait 1 minute and if no new input Debate assessment |
| Special policy 1 | Debate from reactions | Reset existing NIU | Capture past input and then Change topic 5 |
| Special policy 2 | Debate from reactions | Reset next inputted NIU | Capture new input and then Change topic 5 |

**Exit Review/Opinion policy 1**:

* After the user gave the acceptance the past review/opinion is captured;

**Exit Review/Opinion policy 2**:

* After the user gave the acceptance, the utterance from the same input as the reaction, or the following utterance will be considered a review/opinion and will be captured. The administrator can afterwards choose not to accept reviews/opinions that are not complaining with some rules. Different NLP solutions can be implemented on the review corpus, but this is not in scope of this project;

**Exit, no action or no reaction:**

* Any input by the user.

Implementation of Natural Output Generation models

* 1. Training and additional models
     1. Database training

Rasa are incremental training; sa atingem subiectul

**Objectives:**

* Training the database for Pirkin Model;
* Training the database for Chitchats, Replies and back up answer;

**Dependencies:** NOG from databases/NIU;

**Database/ Vocabularies/External needed:** Core intents Database, Restaurants Database, Chitchats & Reply databases;

**To dos:**

**Pirkin model**

* The database with questions will go through NIU sub-layer (the same as an input) except: CVM, IVM, AVM, Backup, Secondary, Books processing, Auto Complete, Triggering, Domain Validation, SPCA memory;
* Each resulted SPCA (that will have k-vector’s and an embedding vector’s) will be linked with the answer from the databases and chronological indices will be applied.

**E2E – DL model**

* + - It will be a standard training included into an E2E model. Also the answers will be marked not to duplicate. See also chapter 4

**Phyton code:** see NIU and Chitchat proposed algorithms.

* + 1. Books training

**Objectives:**

* Training books for intents;
* Using Books processing output;
* Making summarization using SPCA for all books output database;

**Dependencies:** NOG from books/NIU/ Books processing;

**Database/ Vocabularies/External needed:** Books Input Database, Books Output Database;

**To dos:**

**Intents:**

* The Book Input Database will go through NIU – Machine Learning sub-layers except: Backup, Secondary, Books processing, Auto Complete, Triggering, Domain Validation, SPCA memory – keep in mind that in Book processing we’ve also used Machine Education;
* The resulted SPCAs will be linked with immediate results from the Book Output Database, to establish the chapter/subchapter that will be queried. These results will be linked with Labyrinth model and the principles from the deep conversational answers.
* The chapter will be blocked in the user queries states in order not to exist without taking into account the exit terms stipulated in the user queries sub-layer.

**NOG5 Summarization**

* The Book Outputs Database will go through the same process as Database training for Pirkin Model.
* The resulted SPCA will be kept for Labyrinth model – NOG5 Summarization; the immediate answer will apply,

**Phyton code:** see NIU

* + 1. NLG enhancements (AGI)

**Objectives:**

* Determining if the speech of the user can be regarded as formal or informal;
* Calculating a scoring to determine the face reaction of the bot (avatar);

\* More enhancements will be presented in the next sub-layer

**Dependencies:** Chitchats/Untrained NIU/Domain validation/ Reaction analysis/EER/AVM

**Database/ Vocabularies/External needed:**

**To dos:**

1. Each category of chitchat/SPCA3 (10) and of reaction (9) and Untrained (emoji/metaphors/abbreviation/expression/quotes) are allocated a scoring for informal/formal speech and face reaction between 0 and 1.
2. If scoring for informal/formal becomes more than 1 all the NOG’s for this user will be informal.
3. Displaying the avatar after calculating the scoring. We will have 6 avatars, consistent with EER categorization (smile, sad, laughing, cool, kiss and blink). If no other SPCA3/secondary flow inputs occur, the former avatar is still displayed.
4. Include in AVM the scoring for informal/formal and avatar in Column 8 and 9.

**Phyton code:** bucurieesti bot code + new

* + 1. Self-generative model (AGI)

**Objectives:**

* Assessing if the user is qualifying for receiving self-generative responses/reactions;
* Determining possible external impact on the bot reactions/responses/mood;
* Assessing how the bot behavior can change over time. The bot answers can be different in time and will be adapted to external factors and his changing behavior;

**Dependencies:** Bot queries/NLG enhancements/Domain classification/NOG Answers/ Reaction analysis/Auto-training/AVM;

**Database/ Vocabularies/External needed**: sites with news/weather/sports + 1 book per month (grounding principles applies);

**To dos:**

1. Assess criteria for Self-generative model (SPCA4+feedback+informal);
2. Choose the sites that the bot will be assessing daily (news/weather/sports) + books to include in database monthly;
3. Assess the daily main news and monthly book by using reaction analysis. Also the weather/sports results will have negative or positive impact on the bot behavior/mood. All this will be quantified and will determine pessimist/optimist behavior. If the result is neutral than the feedback will impact.
4. The pessimistic/optimistic indicator will be send to NOG from books and will impact the answers (the core intents/ answers will not be impacted).
5. A bot behavioral changes indicator will be created by dividing the number of daily optimistic behavior to the pessimistic ones. This percentage will also be sent to NOG and will have impact on the answers (using disclaimers to show trust or doubts referring to his own answers).
6. Include in column 10 and 11 of the AVM the indicators for behavioral changes and pessimistic/optimistic.

**Phyton code:** new + Reaction analysis sub-layer algorithms + AWS solutions (Amazon Kinesis/Data Steaming) +UIPath for external API.

* 1. Pirkin 4 model implementation. NOG from databases
     1. Chitchat + Untrained answer

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **NOG 3 initiated** | **States** | **E2E Secondary** | **SPCA3 mapping rules** | **Duplicate answer** | **NOG/Solution** |
| 1. | yes | Diatribe | yes | Yes/no | no | The bot will give the answer identified by Secondary flow E2E and update AVM. No core answers. |
| 2. | yes | Dialogue/ Discourse (+Diatribe) | yes | Yes/no | no | The bot will give the answer identified by Secondary flow E2E and update AVM. Also a core answer is pending from SPCA answer of back up answer. |
| 3. | no | all | Yes/no | Yes/no | Yes/no | No NOG for chitchat/ untrained |
| 4. | yes | Diatribe/ Discourse/ Dialogue | no | Yes (2 or 3 matches) | no | NOG for SPCA3 + Confidence Disclaimer |
| 5. | yes | Diatribe/ Discourse/ Dialogue | no | Yes (4 matches) | no | NOG for SPCA3 + w/t Confidence Disclaimer |
| 6. | yes | Diatribe/ Discourse/ Dialogue | yes | Yes (at least 2 matches) | yes | NOG for SPCA3 + Confidence Disclaimer if needed |
| 7. | yes | Diatribe/ Discourse/ Dialogue | no | Yes (3 or 4 matches) | yes | Search for NOG/ SPCA3 with less matches and different answer + Confidence disclaimer |
| 8. | yes | Diatribe/ Discourse/ Dialogue | yes | no | yes | No NOG for chitchat/ untrained |

1. In order for SPCA Rules to apply, we need minimum 2 matching at least for SPCA (both in terms of k-vector and embedding vector).
2. In order for an embedding vector to be considered a match, we will include a deviation of max. 1.5 points for each column with values between -3 and 3.
3. If NOG is a solution, then NLG enhancements will be assessed in order to establish if the answer will be formal or informal, or an avatar changing is necessary.
4. If SPCA has more then one intent associated with an answer, then the priority is the number of matches or the Subject over Predicate over Complement.
5. AVM is being actualized.
   * 1. SPCA core answer (database)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **NOG 1 / 2 initiated** | **NER** | **DER** | **SPCA mapping rules** | **Duplicate answer** | **NOG/Solution** |
| 1. | yes | no | no | Yes (2-4 matches) | Yes/no | Deep conversational is activated |
| 2. | yes | no | budget | Yes (1-4 matches) | Yes/no | NOG from SPCA1 plus confidence disclaimer if needed |
| 3. | yes | no | no | no | yes/no | IDNK (I do not know disclaimer) |
| 4. | yes | core | no | Yes (2-4 matches) | no | NOG from SPCA1 plus confidence disclaimer if needed |
| 5. | yes | core | no | Yes (2-4 matches) | yes | Search for NOG/ SPCA1 with lesser matches/ different answer |
| 6. | yes | core | budget | Yes (1-4 matches) | Yes/no | User queries 1 initiated |
| 7. | yes | more cores\* | Yes/no | Yes (2-4 matches) | no | The prioritization of NER’s + NOG from SPCA1 |
| 8. | no | - | - | - | - | IDNK |

1. In order for SPCA Rules to apply, we need minimum 2 matching, at least for SPCA (both in terms of k-vector and embedding vector).
2. In order for an embedding vector to be considered a match, we will include a deviation of max. 1.5 points for each column with values between -3 and 3.
3. If NOG is a solution, then NLG enhancements will be assess in order to establish if the answer will be formal or informal, or an avatar changing is necessary
4. If SPCA has more then one intent associated with an answer, then the priority is the number of matches or the Subject over Predicate over Complement.
5. At this stage, Dialogue and Discourse states will be treated the same (we are after the additional/confirmation questions possible phase).
6. IDNK- “I don’t know” reply – at least 20 types of answers that will be provided random and no duplicates.
7. SPCA contains the 5th category of adverbs (where) – an algorithm that match the current position of the user (or the desired location) with the GPS locations defined in NER will be activated in order to find solutions (it is implemented in bucurieesti.ro bot).

\*the bot is multi-domain and the user is using core-NER for more domains,

* + 1. Back up answer/E2E DL model (database)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **NOG 1 / 2 initiated** | **NER/DER dates,no** | **Type of backup** | **Training scale/efficiency** | **Duplicate answer** | **NOG/Solution** |
| 1. | yes | no | 1.0 | More than 80% | no | NOG generated by E2E model + AVM/NLG enhance. update |
| 2. | yes | no | 1.0 | More than 80% | Yes | Pirkin model initiation |
| 3. | yes | no | 1.0 | Less than 80% | yes/no | IDNK or Pirkin model initiation |
| 4. | yes | Main NER | 1.2 | More than 80% | No/yes | NOG generated by E2E model + AVM/NLG enhance. Update + user queries 1 state initiation |
| 5. | yes | Main NER | 1.2 | less than 80% | No/yes | IDNK or Pirkin model initiation + user queries 1 |
| 6. | yes | DER | 1.1 | 100% | No/yes | back-up answer & task oriented completion |
| 7. | yes | DER | 1.1 | Less than 100% | No/yes | Bot queries 1, no back up answer |
| 8. | yes | core | 1.0 | More than 80% | Yes/no | NOG generated by E2E model + AVM/NLG enhance. Update |
| 9. | yes | more cores\* | - | - | - | This solutions will probably not work for multi-domains/ Pirkin initialization |
| 10. | no | - | - | - | - | IDNK |

1. If NOG is a solution, then NLG enhancements will be assessed in order to establish if the answer will be formal or informal, or an avatar change is necessary.
2. At this stage, Dialogue and Discourse states will be treated the same (we are after the additional/confirmation questions possible phase).

\*the bot is multi-domain and the user is using core-NER for more domains,

* + 1. Conversational analysis (AGI)

**Objectives:**

* Determining if the Pirkin-SPCA model is better suited (as a principal model trained) for a configurated bot or the E2E DL model.
* Calculating a scoring for each interaction that the bot is having and a consolidated scoring that can show the results of the bot.

**Dependencies:** CPL/Auto-training/Back up model/Reactions/IVM/AVM

**To Dos:**

1. Each bot will have Pirkin model as the initial, custom model for the core-intents.
2. Calculating a scoring for each interaction. Two indicators will be evaluated: 1. no. of turns 2. User reactions.
3. Calculating the average of the scoring for interactions only with custom model.
4. Calculating the average of scoring for interaction where back-up answers were given.
5. At each x interactions compare 3 with 4.
6. If results from point 4 are better then 3 backup model will become custom model.
7. Repeat the process.

**Phyton code:** new.

* + 1. Questions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of questions | When are they  used? | Database | Parameter | Meaning of the questions | Bot actions |
| Additional 1 | Triggering | 5 random | NER or  highest frequency | Specific additional questions related to the parameter | Debate assessment |
| Additional 2 | Triggering | 5 random | no | General additional question to provide more details | Debate assessment |
| Additional 3 | Discourse state policies/ User queries state | 10 random | no | Clarification of the intent | Debate assessment |
| Confirmation | Discourse state policies | 10 random | no | Asking the user if he is interested in the bot view on the matter | Debate assessment |
| Review/Opinion 1 | Discourse state policies | 5 random | no | Asking the user if he can capture the past user discourse as an opinion/review | Debate/Special policies |
| Review/Opinion 2 | Dialogue state policies/ Diatribe | 5 random | no | Asking the user if he wants to give as a review, informing the user of GDPR implications if he chooses to sign the review/opinion | Debate/Special policies |

Attention not to duplicate Questions – Check AVM before answering

* + 1. Change Topic

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of change topic** | **When is it used?** | **Database** | **Parameter** | **Meaning of the topic change** | **Bot actions** |
| Change Topic 1 | Consecutive Diatribe states | 10 random | no | The user needs to understand that this is not a chitchat and redirect to core-intents. | Debate assessment |
| Change topic 2 | Debate- Review | 5 random | no | The user doesn’t want to give reviews. Redirect to proposed core-intents. | Debate assessment |
| Change Topic 3 | User queries 2 | 5 random | no | Redirect to existential topics. | Debate assessment |
| Change Topic 4 | Debate/NOG 4 – 3rd flow | 5 random | no | The debate risks to become boring. | Debate assessment |
| Change Topic 5 | Special policies | 5 random | no | Thank the user for the review/opinion and than initiate a new discussion. | Debate assessment |

Attention not to duplicate – Check AVM before answering

* + 1. Disclaimers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of disclaimers** | **When are they used?** | **Database** | **Parameter** | **Meaning of the disclaimers** | **Bot actions** |
| Disclaimer 1 | Labyrinth – User doubts | 5 random | no | Explaining that we will follow the book chronology | no |
| Disclaimer 2 | Labyrinth – change chapter | 5 random | no | Let the user understand that the bot is changing the chapter of the book | no |
| Disclaimer 3 | Labyrinth – promoting books | 5 random | no | Arguing that it is better to read the entire book for a better understanding | no |
| Confidence disclaimer 50% | Matching SPCA | 5 random | no | The following answer is with 50% confidence | no |
| Confidence disclaimer 75% | Matching SPCA | 5 random | no | The following answer is with 75% confidence | no |
| Disclaimer - doubts | Self Generative model | 5 random | no | The bot has a bad period | no |
| Disclaimer - trust | Self generative model | 5 random | no | The bot has a good period | no |
| Disclaimer – no answer 1 | NOG 6- bot queries 2 | 5 random | no | In this cases the bot is constraining from an answer | Debate assessment |
| Disclaimer – no answer 2 | NOG 6- bot queries 2 | 5 random | no | The bot prefers not to give an answer that can be wrong | Debate assessment |
| Disclaimer 4 | NOG 6- bot queries 2 | 5 random | no | The bot is giving an answer anyway | no |
| IDNK | Many sub-layer | 30 random | no | Either it doesn’t know the answer or doesn’t have enough data | Debate assessment |

Attention not to duplicate – Check AVM before answering

* 1. Pirkin 5 model implementation. NOG from books queries or from specific/commercial bots
     1. Deep conversational answers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of NOG** | **States** | **Self-generative model implication** | **Paragraphs/ Sentences** | **CVM row 2&3 correlation** | **NOG solutions** |
| NOG 1 from SPCA4 | Discourse | Yes (first +/- BOD and disclaimer) | Paragraph | Don’t apply | The first BOD paragraph linked to the matched BID SPCA that is optimistic or pessimistic + discl. |
| NOG 2 from SPCA4 | Dialogue | Yes (first +/- BOD, w/t disclaimer) | Last Sentence | apply | The last sentence from the BOD paragraph linked to the matched SPCA that is +/-, and match CVM |
| NOG 5 next | User queries 2 | Yes (first +/- BOD and disclaimer) | Last Sentence | apply | The last sentence from the BOD paragraph linked to the matched SPCA that is +/-, match CVM + discl. |
| NOG 5 beginning | User queries 2 | Yes (disclaimer) | Paragraph | Don’t apply | The first BOD paragraph linked to the matched BID SPCA + disclaimer |
| NOG 5 next beginning | User queries 2 | Yes (first +/- BOD and disclaimer) | Paragraph | Don’t apply | The second BOD paragraph linked to the matched BID SPCA that is optimistic or pessimistic + discl. |
| NOG 5 next plot | User queries 2 | Yes (first +/- BOD, w/t disclaimer) | Paragraph | apply | The third BOD paragraph linked to the matched BID SPCA that is +/-, and match CVM |
| NOG 5 summarization | User queries 2 | Yes (first +/- BOD and disclaimer) | SPCA | Don’t apply | The first SPCA summarization of BOD paragraph linked to the matched BID SPCA that is +/-, +discl. |
| NOG 5 last section | User queries 2 | Yes (disclaimer) | paragraph | Don’t apply | The last BOD paragraph linked to the matched BID SPCA + disclaimer |
| NOG 5 introduction | User queries 2 | no | paragraph | Don’t apply | The first paragraph of the book/ not linked |
| NOG 5 second answer | User queries 2 | Yes (first +/- BOD, w/t disclaimer) | paragraph | apply | The second BOD paragraph linked to the matched SPCA that is +/-, and match CVM |
| NOG 5 writer present. | User queries 2 | no | paragraph | Don’t apply | The paragraph from chapter 3 writer presentation |

1. The CVM of the SPCA will be mapped to the answers CVM from the Book Output Database. Confidence disclaimer will be replaced by Behavioral disclaimer.
2. The matching will be done similar with SPCA core answers without DER or NER implications; AVM will is being actualized.
3. If the chapter doesn’t have enough paragraphs available for labyrinth model – IDNK disclaimer is provided.
   * 1. Commercial bots answers

**Objectives:**

* Integrating a commercial bot in Cezanne.ai platform and in the bot database.

**Dependencies:** Pirkin model;

**Database/ Vocabularies/External needed**: Integrated Commercial database with Q&A’s

**To Dos:**

1. The Subject of SPCA will be replace by the NER of the commercial bot when user-queries 1 is initiated.
2. The back-up and secondary will be inactivated.
3. CPL will be inactivated except Reaction analysis that will determine exit condition.
4. From NOG only SPCA core answer will be active.
5. All the utterances-answers will be included also in the main Commercial database (with the NER included even if redundant) for cases when the user is inputting also NER1 and the user-queries 1 hasn’t been initiated.
6. In Cezanne.ai platform only the integrated database needs to be uploaded with specification of the NER1.

**Phyton code:** adapted Pirkin model

* 1. Pirkin 6 model implementation. NOG from intuition
     1. NOG 6 – Bot queries 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type of task** | **NER1** | **DER date** | **DER number** | **DER hour** | **NOG solution** |
| Make reservations/ Schedule a meeting | yes | yes | yes | yes | Ask for confirmation |
| no | Ask for DER hour |
| no | n/a | Ask for DER number (example: the persons that will attend) |
| no | n/a | n/a | Ask for DER date |
| no | n/a | n/a | n/a | Ask for NER1 |

1. NER1 is the top entity that should refer to name of restaurants, doctors, lawyers, bankers…
2. When initiated NOG6 – queries 1 is giving a disclaimer of the user intention that can contain an external link for selling/task oriented purposes or the reservation or schedules can by done by bot queries 1 or additional interfaces
3. The bot needs to perform 4 steps in order (NER1, DER date, DER number, DER hour) but first will check NER1 and DER if this information are already provided. After each step he will evaluate NER1 and DER and go to the next step
4. After all the steps it will ask for a confirmation.
5. The bot will have databases with questions for reservation and meeting schedule
   * 1. NOG 6 -Bot queries 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DER\*** | **Bot Queries 2.0** | **DER 1** | **Bot queries 2.1** | **DER 2** | **NOG solution** |
| 70-89% | Has doubts regarding some ideas/topics | None\*\* | n/a | n/a | Initial NOG 1,2,3,4,5 |
| 10-90% | Interest in the person | 10-90% | Disclaimer no answer 1 |
| 50-69% | Has interest in the user as a person | none | n/a | n/a | Initial NOG 1,2,3,4,5 |
| 10-90% | Interest in his opinion | 10-90% | Disclaimer no answer 2 |
| 30-49% | Has interest in the user opinion | none | no | n/a | Initial NOG 1,2,3,4,5 |
| 10-90% | Shares its thoughts | 10-90% | Initial NOG 1,2,3,4,5 + disclaimer 4 |
| 10-29% | Wants to share its thoughts | none | no | n/a | Initial NOG 1,2,3,4,5 |
| 10-90% | no | n/a | Initial NOG 1,2,3,4,5 |

1. We will have a database with 10 bot utterances for each of the 4 policies of the bot queries 2. The utterance will contain the adjective/superlative/adverb whose meaning the bot wants to clarify.
2. The utterances will be generated in chronological order, checking AVM to see the last bot utterance used and not to duplicate.
3. Only 2 maximum consecutive bot queries 2 will be performed before answering, if the user doesn’t exit before (exit condition in the CPL states).

\*refers at DER relatively vector

\*\*none refers also to the cases DER is less than 10% or higher than 90%

* + 1. NOG 4 – 3rd flow

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **3rd flow** | **First 3rd flow** | **Current SPCA1/4** | **NOG/Solution** |
| 1. | Responding to good news/ Showing agreement/ Linking to your own story | yes | n/a | NOG 4 from specific 3rd flow database |
| no | n/a | Change topic 4 |
| 2. | Responding to bad news/ Getting the user to say more/ Showing surprise | Yes/no | complete | NOG 4 + rephrase + last 2 words of the SPCA classified utterance |
| yes | incomplete | NOG 4 + rephrase + missing SPCA |
| no | incomplete | NOG 4 + rephrase + last 2 words of the SPCA classified utterance |

1. We will have a database with 10 bot utterances for each of the 6 policies of the 3rd flow.
2. The utterances will be generated in chronological order, checking AVM to see the last used bot utterance and avoiding duplicates.
3. The policies where the bot utterance will contain rephrase database are marked with red.
4. Even if the bot used E2E DL model to answer, the SPCA will be used to elaborate NOG4.
5. Rephrase database: 10 bot utterances that will contain either missing S/P/C/A, either the last two words of the user’s utterance classified as SPCA1 or SPCA4.

Cezanne.ai platform

One of the most important benefits of the model is that it is designed to accommodate multi-domain bots, limited databases and complex business objectives that include advisory sessions, socializing or creative discussions through the art of conversation. Furthermore, commercial chatbots and task-oriented platforms can be integrated for enhancing the business objectives.

The prototype that was conceptualized and detailed in the previous chapter has a custom configuration, but by implementing Cezanne.ai in a UI platform it will be easy to customize the bot depending on different needs.

* 1. Prototype configuration

|  |  |  |  |
| --- | --- | --- | --- |
| **Topic** | **Prototype specific** | **Dependencies** | **Does the model permit other configurations?** |
| Language | Romanian | Lexicon, many NIU layers have language fundamentals, all Databases in Romanian | Difficult, by adapting the algorithms |
| Grounding | Bucharest | Databases for core-intent linked with Bucharest | Yes |
| Advisory Bot | Restaurant industry | Databases | yes |
| Commercial bot | Restaurant | Databases | yes |
| Deep conversational | Existential issues | Databases; deep conversational can be on the same topic as core-intents | yes |
| Questions/Change topics/ Disclaimers | Restaurants and existential | Databases | yes |
| Chitchats topics | 10 categories + 11 subcategories | Specific Databases and models | No, but can be eliminated |
| Reactions types | Fundamental | Specific Databases and models | no |
| Intuition | Fundamental | Specific Databases and models | No, but can be eliminated |
| Multi-domain bot | Restaurant + existential | Databases and books | yes |
| Books training | 3 different types | Only 3 types are accommodated (novels, scientific and scripts) | yes |
| Database training | Restaurant recommendation | Database with specific utterances and answers | yes |
| NER | Restaurant specific | Database with NER with prioritization (core and generalities) | yes |
| Task-oriented | Reservation | User queries 1 – adapted to reservation | yes |

* 1. Platform configuration

|  |  |  |
| --- | --- | --- |
| **Topic** | **Possibilities** | **What needs to be done for configuration** |
| Grounding | all | Provide databases adapted to the grounding chosen and the location for implication over self-generating model |
| Advisory Bot | All in scope of the paper | Provide databases with NER and training (see below) |
| Commercial bot | all | Provide commercial database |
| Deep conversational | all | Choose the topic (the same with the core or from the books uploaded) |
| Questions/Change topics/ Disclaimers | all | Provide databases with minimum 5 choices for each type |
| Multi-domain bot | All in scope of the paper | Upload databases for each domain; be careful at generalities and prioritization |
| Books training | (novels, scientific and scripts) | Upload books, specifying the type and a description of the author |
| Database training | All in scope of the paper | Upload databases with utterances and answers; utterances can be simple sentences, as SPCA can accommodate this type of labeling |
| NER | All | Provide databases with NER and their priority. For NER location provide also GPS coordinates for the additional algorithms |
| Task-oriented | Reservation/meeting schedules | Define the type of task-oriented and questions (database) for bot queries 1 or input a link in the bot queries 1 to redirect the conversation to a selling platform, for example |

Cezanne.ai project initiation

We will use as foundation the detailed NIU-CPL-NOG model and start to implement Cezanne.ai project that has the objective of realizing a Human-Level conversational bot. Because the framework incorporates systems theory from cybernetics, all the positive conclusions can make a strong case for E2E/DL models to become obsolete when it comes to building conversational bots. In the implementation phase we will use the exact steps, layer, details and proposed solutions that were presented in the first three chapters.

This chapter is divided in two sub-chapters:

1. **Resources/roles/timeline**. Presenting to the possible sponsors/owners/partners/ contributors/co-authors the necessary resources needed + the existing project progress for the implementation of the project
2. **Open points**, subject of agreement with the future sponsors/owners/partners/ contributors/co-authors
   1. Resources/roles/timeline

Current progress:

* Functional specification - 90% completed (pending: partners input)
* Existing Resources:
  + PM (RES1)
  + Architect (RES2)
  + Python programmer (RES3)
* Existing programs/codes – 30% of the final code
* Existing code adaptation – deadline: 1st September 2021 with existing resources
* Architecture – 80% completed (pending: partners input)
* The in-house progress will be done with limited databases, not with the final databases

Main proposals:

* Programming language: Python
* Implementation language: to be decided (TBD) with the partners. Proposed: Romanian
* Core intents: restaurant recommendation/TBD
* Cloud solution: TBD
* Additional human resources: 5
  + 1 database specialist (RES4)
  + 1 NLP Engineer – Team leader (RES5)
  + 1 Python programmer (RES6)
  + 1 Integration developer (RES7)
  + 1 tester (RES8)
* Timeframes includes 1 day of kick off/recurrent testing /1 day architecture accommodation
* Project implementation: 6 months (including Beta testing) – starting 1st September 2021 with all team

NIU- Machine Education:

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Layer | Existing Resources | Additional resources | Timeframe |
| Auto-Correct | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| Input processing I | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| Composed words | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| NER | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| Emoji (EER) | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| Grammar/Semantics | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| DER | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| Splitting sentences | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| CVM | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| IVM | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |
| AVM | RES1+RES2+RES3 | RES4+RES7+RES8 | Present- 1st October 2021 |

NIU- Machine Learning:

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Layer | Existing Resources | Additional resources | Roll out Deadline |
| Reply | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Chitchat | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Untrained NIU | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Input processing II | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Database processing | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Books processing | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Auto Complete | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Embedding | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Triggering | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Domain Validation | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| SPCA- Memory update | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |
| Main flow/Back up | RES1+RES2+RES3 | RES4+RES5+RES7+RES8 | 1st August- 1st November |

CPL:

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Layer | Existing Resources | New resources | Timeframe |
| Reaction analysis | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Reset | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| States | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Discourse | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Dialogue | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Diatribe | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Debate/ other states | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Debate/ reactions | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| User queries | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Labyrinth model | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Bot queries | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |
| Special policies | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 1st November- 15th December |

NOG:

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Layer | Existing Resources | New resources | Timeframe |
| Database training | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Books training | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| NLG enhancements | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Self-generative model | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Chitchat answers | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| SPCA core answers | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Back up answers | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Conversational analysis | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Deep convers. answers | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Commercial bot answer | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Questions | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Change topics | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| Disclaimers | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| NOG6- bot queries 1 | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| NOG6- bot queries 2 | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |
| NOG4 – 3rd flow | RES1+RES2 | RES4+RES5+RES6+RES7+RES8 | 15th December – 1st February |

Platform:

|  |  |  |  |
| --- | --- | --- | --- |
| Sub Layer | Existing Resources | New resources | Timeframe |
| Platform configuration | RES1+RES2 | all | 1st February-1st March |

* 1. Open points

Actualizat totul

1. If we use the same model for replacing operating systems or programming with a natural language/conversational method, will we have the same results?
2. The importance of different languages/cultures specificities in NLU. We will check if our cleanup inputs (using specificities of the language) are more intelligible than the actual-complete user input.
3. Is our model performing better than language platforms like wit.ai in terms of NLU? Can an extension of NLU (NIU – complete understanding of the input) make a difference especially in labeling?
4. Will our model do a better job than a conversational bot using the state-of-the-art E2E transformer model that is using Google or Amazon infrastructure (on three levels: core intents, chitchats and reactions)? We will import the same database in both models and evaluate the results. We will use also cleanup inputs vs complete user inputs to analyze the reasons behind the differences.
5. The options of using IDEs (AWS SageMaker, Microsoft Azure or Google Colab) will be analyzed with the future co-authors, but most probably without NLU solutions (Lex or Dialogflow) that are either available in limited languages, either do not work properly for some languages.
6. Evaluate the results of Auto-training proposal, especially on the NIU component.
7. Machine education vs Amazon Comprehend for some languages covered by AWS solutions.
8. Labyrinth model vs Amazon Kendra.
9. Labeling SPCA vs normal labeling of simple-to-complex utterances.
10. Cezanne.ai vs OPEN AI on different layers/sublayers.
11. Cezanne.ai vs Inria- Flowers project – on developmental robotics approach (all the proposed AGI concepts, especially Machine Education).

Additional questions for those who are interested to be co/authors, contributors, sponsors or partners to the project:

1. Will AGI concepts be open-source?
2. Using cloud or on-premises? If cloud, choose providers and define Kubernetes needs.
3. Include also sites corpuses in the labyrinth model and book processing/training, even if it is not a fundamental solution?
4. Will we agree on an open-source code or not?
5. Other languages to be tested and researched, including a globally known language.
6. Is Trax from Google (that has Tensorflow and Keras included) a suited framework for a E2E/DL model? Are CUDA and cuDNN libraries optimal for parallel training?

We will keep the users’ interactions for testing with our existing conversational bot (bucurieesti.ro) made after we imported the project repository in GitHub – for objective reasons.

*– this part is a work in progress together with security remediations and predictive maintenance solutions. Agreeing a plan with roles, resources and timeline are subject to discussion with co-authors/contributors/ partners.*

Future enhancement (proposed): visual recognition of images/GIFs inside a NIU corpus + automatic speech recognition (ASR)

1. Cezanne.ai after the famous painter of “The conversation”; There are similarities with Paul Cezanne work also in terms of the hybrid view. [↑](#footnote-ref-1)
2. it incorporates elements of a functional specification document and a detailed architecture & solution of the proposed framework. [↑](#footnote-ref-2)