

# Programming Exercise

## Initial Description from Client:

- Suppose our client is a multinational company providing various IT-related services. Those services include but are not limited to, cloud services (storage services, packages, computation services), etc.
  - The company is receiving an enormous number of emails from their customers. Those emails are related to various subjects which again include, but are not limited to, request for refunds, service quality-related issues, some suggestions, etc.
  - Each of these emails can be classified into different classes on more than one different level. For example, an email can be classified as 'complaint' for level 1, 'IT service' for level 2, 'cloud autoscaling' for level 3, and 'under-provisioning of HDD' for level 4, where each level can have multiple classes to classify in.

## The objective of the Project:

Our client has hired hundreds of agents to go through the emails and respond to queries of their customers. As a result, our client is bearing the high cost to provide this service to their customers. Also, their customers' experience is very bad because they must wait for days (even weeks) to get a response from the agents.

Our client has decided to develop a chatbot that will automatically read the emails of customers and respond to them in the best manner. As a first step towards developing such a chatbot, our client wants to develop an ***email classifier that can classify emails into multiple classes*** (one class on each level).

## Sample Data Format:

Ticket id	Interactio	Interactio	Mailbox	Ticket Sur	Interactio	Innso	Type	Type 1	Type 2	Type 3	Type 4		
24310	68365	support.e	[Company Mxxxxx@AppGaller	AppGaller	AppGaller	Others							
24075	67730	support.p	[AppGalle Beschreib	AppGaller	AppGaller	Problem/	AppGaller	Can't update Apps					
24075	67762	support.p	Re: RE : [A Danke Na	AppGaller	AppGaller	Problem/	AppGaller	Can't update Apps					
23748	66706	support.p	[AppGalle Descriptive	AppGaller	AppGaller	Suggestio	AppGaller	Others					
23740	66684	support.eu	@Service Ho pagato	AppGaller	AppGaller	Problem/	Third Part	Refund					
23683	66429	support.e	Service Su Product: A	AppGaller	AppGaller	Suggestio	VIP / Offe	Offers / Vouchers / Promotions					
23683	67433	support.e	Re: RE : Se Hello , go	AppGaller	AppGaller	Suggestio	VIP / Offe	Offers / Vouchers / Promotions					
23683	67516	support.e	Re: RE : Se I have to e	AppGaller	AppGaller	Suggestio	VIP / Offe	Offers / Vouchers / Promotions					
23683	67915	support.e	Re: RE : Se Sure, the	AppGaller	AppGaller	Suggestio	VIP / Offe	Offers / Vouchers / Promotions					
23624	66266	support.p	[GameCer Descriptive	AppGaller	AppGaller	Problem/	AppGaller	Can't download Apps					
23555	65977	support.p	[AppGalle Descrição	AppGaller	AppGaller	Problem/	General	Cannot connect - Server					
23534	65883	support.p	[AppGalle Beschreib	AppGaller	AppGaller	Problem/	AppGallery-Install/	U Can't install Apps					
23477	65661	support.p	Re: suppo Huawei he	AppGaller	AppGaller	Others							
23452	65616	support.p	[AppGalle Descriptive	AppGaller	AppGaller	Problem/	AppGaller	Can't install Apps					
23429	65569	support.p	[AppGalle Descriptive	AppGaller	AppGaller	Problem/	AppGaller	Can't install Apps					
23395	65482	support.p	[AppGalle Descriptive	AppGaller	AppGaller	Others							
23230	65024	support.p	[AppGalle Descriptive	AppGaller	AppGaller	Others							
23229	65022	support.p	[AppGalle Описание	AppGaller	AppGaller	Others							
23212	64982	support.p	[AppGalle OK Описа	AppGaller	AppGaller	Others							
23194	64946	support.p	[AppGalle Beskrivel	AppGaller	AppGaller	Problem/	AppGaller	Other download/install/update issue					
23193	64944	support.p	[AppGalle Beskrivel	AppGaller	AppGaller	Problem/	AppGaller	Other download/install/update issue					
23190	64929	support.p	[AppGalle Описани	AppGaller	AppGaller	Suggestio	General	Personal data					

Our client provided some data to further understand their technical requirements (They promised to provide more data next week and will keep providing it during the project duration). The data is attached to Moodle. At this stage, the client only provided the data for a single business scope i.e.,

the emails they got about their application gallery service. The format of the sample data provided is given above. For more detail see the worksheet attached on Moodle page.

## Initially planned activities:

Seq.	Activity to perform	The expected way to perform	Activity Resource	Estimated Duration
1	Data Selection	Skipping few columns	Deleting from worksheet	3 hour
2	Data grouping	Ticket based grouping of conversation	Data group-by facility in python	3 hour
3	Deal with multiple languages	Translate them all into English	May be using some NLP resources using Python's libraries	2 days
4	Deal with noises in data	E.g., removing frequent less important words (thank you for your email)	Regular expressions in python	1 days
5	Dealing with multi-level data	Multi-level modelling or multi-class	Brainstorming activity: Language do have support for both	1 day
6	Textual data representation change	Numeric representation of text	Libraries in python	1 day
7	Dealing imbalanced data	E.g., similar number of minimum records for each class	Libraries in python	Half day
8	Decide on we want supervised or un-supervised learning: Brainstorming activity			
9	Data preparation for modelling	Separate training testing data	Libraries in python e.g., train_test split in sklearn	2 hour
10	Model selection for email classification	Use an appropriate (SOTA) model that can be use textual data for classification purpose	E.g., Random forest implementation in Python	4 hour
11	Model training, and testing for email classification	Input training data, train model, then use trained model for testing on test data	E.g., Random forest implementation in Python	3 days

## Tasks to do:

Except activity 5, you have been provided the solution for all of the activities (in separate files) presented above. Most of the solutions are in the form of source code but for activity 8 we don't need any source code instead we decided to use supervised learning approach. Why?

Your today's task as an AI Engineer is compile the code so that we have a working system as soon as possible because we want **Small releases as per agile methodologies**. Therefore, we want to put a simple system into production, then release new versions in a very short cycle.