Retrieve Relevant Code Components from a Repository

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ABSTRACT

The cognitive agent system helps to retrieve most relevant code component by introducing latest techniques. In this paper the authors used latest approach of code embedding which undergoes code2vec tokenization model by tokenizing and converting the code components present in the dataset into a numeric representation to create a input for neural network environment and also implemented cosine similarity matching technique to acquire the relevancy and perform retrieval of code component

1. INTRODUCTION

The growth of code component reusability had increased with most of the developers or end users majorly browse for the required code components in the internet, as it is providing many open source software code components. The user generally enters query in natural language and get plenty of results among which the relevancy of required code component is less, as it contains huge amount of noisy data than relevant data. To overcome this problem the authors introduced a cognitive agent system to retrieve most relevant code component from the repository. As per the work done to implement the concept the authors made use of a latest approach called Code2Vec. This is a neural embedding process of converting the code components into numerical representation called vectors. According to Piyush Arora etal[1], The conversion of code component to vectors can be done in three ways - one is general code as vectors in which the spaces or new lines and stop words are eliminated using tokenizer, another

one is tokenization in which it provides the lexical scanner for the code components to convert into vectors, and last one is AST(abstract structure tree) in which the code components are separated depending on their relationship and represented in the form of a tree. In this work natural language processing is used to perform the retrieval. The code2vec is mainly used to predict the method names. With an idea of fetching the method or code snippet of a particular method, it was decided to implement Code2vec concept as it was proven as effective code embedding for predicting the methods. As per Hong jin kang[2], they proposed token embedding's by code2vec to represent the source code in three downstream tasks as code authorship identification, code clones detection and code comment generation but resulted with a thread of not generalizing to other tasks.

By considering these two papers the authors decided to implement code2vec for retrieval process using tokenization. The cognitive agent system has implemented cosine similarity matching technique to fetch the most accurate code component from the repository - as per the Tim vor der Brick etal[4], they have calculated many similarity matching models and demonstrated cosine similarity as most accurate especially on large dataset. By analyzing piece of writings available, the authors have decided to implement a cognitive system which need to be user friendly, get accurate results and gives reusable code components

The vectorization idea is implemented as it reduces the complexity and increases the quality of results. The authors want to develop a user friendly system hence, implemented using "tkinter" to create a user interface and the query which the user enters can be in any random combination to get accurate results. The user input is a combination of features of code components required.

2. PROBLEM STATEMENT

The logic for almost all computer programs is readily available and stored in repositories, but we lack the ability to quickly and easily obtain the required component logic. Instead, we must rely on Google, which will retrieve the necessary component logic along with a lot of noisy data, making it challenging for programmers to extract the necessary logic from that massive amount of noisy data.

DISADVANTAGES

almost for logic search we need to depend on Google which will fetch required component logic with lots of noisy data. Its bit difficult for the programmer to get the required logic from that huge noisy data.

3. PROPOSED SYSTEM

Then Cognitive Agent System is the machine training and literacy process which will be train on being depository law element and also a train model will be generated. Whenever stoner give any query(to hunt law element) also Cognitive Agent System will apply train model on that new query to get applicable law element. Always this fashion will recoup only those factors which are satisfying query and make inventor work easier to get needed element sense.

ADVANTAGES

User gives any query then Cognitive Agent System will apply train model on that new query to get relevant code component. Always this technique will retrieve only those components which are satisfying query and make developer work easier to get required component logic.

🦉 Ret	rieve Relevant Code Components			-	٥	×
	Cognitive A	agent System to Retrieve Releva	nt Code Components from a Reposito	ny		
	Enter Query Here					
	E:/manoj/NewAssignment/CodeVec/train loaded					
	Upload Code Dataset	reprocess Dataset	Convert Code2Vector			
	Input Query & Retrieve Component	uery Result Graph	Quit Application			
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4. EXPECTED RESULTS

Now click on 'Preprocess Dataset' button to read all programs and to clean all programs by removing stop words and special symbols. Will get below screen after preprocessing

Retrieve Relevant Code Components			.—	٥	×
Co	gnitive Agent System to Refrieve Releva	nt Code Components from a Reposito	ary		
Enter Que	ny Here				
E:/manoj/NewAssignment/CodeVec/train loaded Preprocessing Task Completed Total Number of Programs in Repository = 101					
Upload Code Dataset	Preprocess Dataset	Convert Code2Vector			
Input Query & Retrieve Component	Query Result Graph	Quit Application		15:01	

In above screen we can see it process total 101 programs and to see processed program names then see black console. See below screen

C:\Wi	ndows\syste	em32\cmd.exe	—	×
Reading	Program	ConcurrentTaskExecutorTests.java		^
Reading	Program	ConcurrentTaskScheduler.java		
Reading	Program	ConcurrentWebSocketSessionDecorator.java		
Reading	Program	ConcurrentWebSocketSessionDecoratorTests.java		
Reading	Program	Condition.java		
Reading	Program	Conditional.java		
Reading	Program	ConditionalConverter.java		
Reading	Program	ConditionalDelegatingFilterProxyTests.java		
Reading	Program	ConditionalGenericConverter.java		
Reading	Program	ConditionContext.java		
Reading	Program	ConditionEvaluator.java		
Reading	Program	HdfsBlocksMetadata.java		
Reading	Program	HDFSConcat.java		
Reading	Program	HdfsConfiguration.java		
Reading	Program	HdfsConstants.java		
Reading	Program	HDFSContract.java		
Reading	Program	HdfsDataInputStream.java		
Reading	Program	HdfsDataOutputStream.java		
Reading	Program	HdfsFileStatus.java		
Reading	Program	HdfsLocatedFileStatus.java		
Reading	Program	HDFSPolicyProvider.java		
Reading	Program	HdfsServerConstants.java		
Reading	Program	HdfsTestDriver.java		
Reading	Program	HdfsUtils.java		
Reading	Program	HdfsVolumeId.java		
Reading	Program	HeaderBlock.java		
Reading	Program	HealthCheckFailedException.java		
Reading	Program	HealthMonitor.java		
Reading	Program	HeapSort.java		
Reading	Program	HeartbeatManager.java		×

In above screen we can see name of each program which was processed. Now click on 'Convert Code2Vector' button to convert all processed program to vector

Retrieve Relevant Code Components	-	٥	×
Cognit	ive Agent System to Retrieve Relevant Code Components from a Repository		
Enter Query I	lere		
AbstractAggregationBuilder, java Counter('[license': 9 oxcontent': 2, 'aggregation': 2, 'public': 2, 'abstractagg : 1, 'additional': 1, 'information': 1, 'regarding': 1, 'copy quired': 1, 'applicable': 1, 'law': 1, 'agreed': 1, 'writing': , 'language': 1, 'governing': 1, 'permissions': 1, 'limitati abstract: 1, 'class': 1, 'implements': 1, 'lipitate': 1, 'sol AbstractArray.java Counter('[license': 9, 'ligarrays': 7 lean': 3, 'released': 3, 'see': 2, 'licensest': 2, 'lawy: 2, 'la ose': 2, 'licensed': 1, 'one': 1, 'contitutor': 1, 'agreeme except': 1, 'compliance': 1, 'obtain': 1, 'copy': 1, 'http: nties': 1, 'compliance': 1, 'likind': 1, 'espress': 'class': 1, 'implements': 1, 'bigarray': 1, 'false': 1, 'clos eturn': 1, 'amplicable': 1) AbstractAsyncAction.java Counter(['license': 9, 'startt' 'apache': 2, 'may': 2, 'org': 2, 'search': 2, 'abstractasyn ; 1, 'additional': 1, 'linformation': 1, 'agreed': 1, 'writing'.	'name': 6, 'string': 5, 'elasticsearch': 4, 'type': 4, 'file': 3, 'distributed': 3, 'org': 3, 'see': 2, 'licenses': 2, 'apache': 2, 'may': 2, 't egationbuilder': 2, 'final': 2, 'protected': 2, 'return': 2, 'licensed': 1, 'one': 1, 'contributor': 1, 'agreements': 1, 'notice': 1, 'work' right': 1, 'ownership': 1, 'version': 1, 'arset': 1, 'escept': 1, 'complince': 1, 'obtain': 1, 'eopy: 1, 'http: 1, 'wwr: 1, 'unless': 1, 'ret ', 'software': 1, 'basis': 1, 'without': 1, 'warranties': 1, 'complince': 1, 'obtain': 1, 'eopy: 1, 'http: 1, 'wwr: 1, 'unless': 1, 'ret ', 'l, 'constructor': 1, 'typical': 1, 'used': 1, 'with': 1, 'dastases': 1, 'built': 1, 'estane': 1, 'serset': 1, 'builders': 1, ' ', 1, 'constructor': 1, 'typical': 1, 'used': 1, 'sub': 1, 'dastases': 1, 'built, 1, 'getname': 1, 'basis': 1, 'builders': 1, 'builders': 1, ' ', 1, 'constructor': 1, 'typical': 1, 'used': 1, 'sub': 1, 'dastases': 1, 'built, 1, 'getname': 1, 'basis': 1, 'builders': 3, 'boilt': 1, 'warra ', 1, 'constructor': 1, 'typical': 1, 'additional': 1, 'imformation': 1, 'regarding': 1, 'conyright': 1, 'ownership': 1, 'yersion': 1, 'wse': 1, ' ', 'umilt': 1, 'unless': 1, 'additional': 1, 'imformation': 1, 'regarding': 1, 'conyright': 1, 'ownership': 1, 'yersion': 1, 'wse': 1, ', 'umilt': 1, 'unless': 1, 'required': 1, 'applicable': 1, 'arv: 1, 'agreed': 1, 'writing': 1, 'software': 1, 'basis': 1, 'without': 1, 'warra ', 'imilt': 1, 'specific': 1, 'anguage': 1, 'governigi': 1, 'permission': 1, 'jent': 1, 'software': 1, 'basis': 1, 'imit': 1, 'software': 1, 'namytesused': 1, 'assert': 1, 'double': 1, 'release': 1, 'true': 1, 'protected': 3, 'getchildresources': 1, 'r ', 'addiustbreaker': 2, 'locenstifie: 2, 'licensest': 1, 'locenset': 1, 'locenset': 1, 'locenset': 1, 'loce': 1, 'locenset': 1, 'loce': 1, 'locenset': 1, 'loce': 1, 'loce'		
Upload Code Dataset	Preprocess Dataset Convert Code2Vector		
Input Query & Retrieve Component	Query Result Graph Quit Application		
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In above screen we can see program name and then its words and its count. Now enter your query in text field and click on 'Input Query & Retrieve Component' button to get all programs which implement that query. Once you build model then you can search any number of queries.

trieve Relevant Code Components		-	٥	×
Cognitive A	gent System to Retrieve Relevant Code Components from a Repository			
Enter Query Here	valueof			
AbstractAggregationBuilder.java Counter({{license': 9, 'name oxcontent': 2, 'aggregation': 2, 'public': 2, 'abstractaggregatio : 1, 'additional': 1, 'information': 1, 'regarding': 1, 'copyright': quired': 1, 'applicable': 1, 'law: 1, 'aggreed': 1, 'vriting': 1, 'sof , 'language': 1, 'governing': 1, 'permissions': 1, 'limitations': 1, abstract': 1, 'class': 1, 'implements': 1, 'private': 1, 'sole': 1, 'c AbstractArray.java Counter({[license': 9, 'bigarrays': 7, 'util': lean': 3, 'released': 3, 'soe': 2, 'licenses': 2, 'mays': 2, 'account ose': 2, 'licensed': 1, 'one': 1, 'contributor': 1, 'agreements': 1, except': 1, 'compliance': 1, 'obstract': 1, 'agreements': 1, except': 1, 'compliance': 1, 'bida': 1, 'eithet': 1, 'except': 1, 'ang 'class': 1, 'implements': 1, 'bigarray': 1, 'false': 1, 'close': 1, 'a eturn': 1, 'emptylist': 1]) AbstractAsyncAction.java Counter([[license': 9, 'starttime': 5, 'apache': 2, 'may': 2, 'org': 2, 'search': 2, 'abstractasyncaction : 1, 'additional': 1, 'fanormation': 1, 'aggreading': 1, 'copyright': quired': 1, 'applicable': 1, 'law: 1, 'aggreed': 1, 'writing': 1, 'sof	: 6, 'string': 5, 'elasticsearch': 4, 'type': 4, 'file': 3, 'distributed': 3, 'org': 3, 'see': 2, 'licenses': 2, 'apache': 2, 'may': 2 builder': 2, 'final': 2, 'protected': 2, 'return': 2, 'licensed': 1, 'one': 1, 'contributor': 1, 'agreements': 1, 'noine': 1, 'wu (, 'ownership': 1, 'version': 1, 'use': 1, 'excerpt': 1, 'conditionse': 1, 'ohati': 1, 'estrest': 1, 'unites': 1, 'wunes': 1, 'uness': 1, 'unites': 1, 'social': 2, 'social': 1, 'so	, 't rk' 're ': 1 1, ' ooo ocl ., ' rra : 1, , 'r : 2, ork' 're ': 1		
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In above screen I entered query as 'valueof' which means I want to get all component which used or contains logic for valueof function. Below are the search results

ve Relevant Code Components					٥
	Cognitive A	gent System to Retrieve Relev	ant Code Components from a Reposit	огу	
	Enter Query Here	valueof			
Below are the Retrieve Compon Amount.java Predicted Score : 0 ConcurrentReferenceHashMap HdfsServerConstants.java Pred	1ent For Given Query 0.05084336812106691 1Tests java Predicted Score : 0. licted Score : 0.0270591652822	.0162537392980951 /73295			
Upload Code Da	ataset	eprocess Dataset	Convert Code2Vector		
Input Query & Retrieve Co	omponent	iery Result Graph	Quit Application		
O Type here to search	4 0 1	2 📄 🔒 🕤	o 🛒 🖂 🔂	ድ ^ዋ ^ <u>8</u> <i>ແ</i> የጋ ባ») "	15:07

In above screen we can see total 3 programs found (Amount.java, ConcurrentReferenceHashMapTests.java and HdfsServerConstants.java)which used or contains

logic for 'valueof'. Now I will open 'Amount.java' program from train folder to see whether it really contains that valueof code or not



In above 'Amount.java' from train repository we can see it contains 'valueOf' function. Similarly you can see any query and get component. Now click on 'Query Result Graph' button to get below graph



In above graph x-axis represents total components and predicted components and y-axis represents it count.

6. CONCLUSION

To increase the reuse of software component, software component repositories and to improve the relevancy of the retrieval process - the authors have used Code2Vec concept in which the dataset is embedded by implementing tokenization technique which converts the whole code components from the dataset into vectors. The cognitive system attained success in retrieving the most relevant code snippet by comparing their cosine similarity measure and made it user friendly by abetting in the form of text document.

7. REFERENCES

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