# Knowledge Discovery From Expert Profile Processing - The Expert Finding Solutions For Pet Domain.

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**ABSTRACT:** The Expert Finding Systems are gaining focus in Universities, HR, Medical and Project Management systems. These systems are way ahead of recommendation systems, which are an extensive class of Web applications that involve predicting user responses to options. Expert Finding Systems look beyond the best-fit expert to solve the end user's problems. These problems can be a query regarding some item, solution, service or trouble shooting some case scenario. This area of research encompasses Artificial Intelligence, Web application engineering and also Software Engineering used to validate the simulated responses of this system. This paper talks about an expert finding system in pet domain. The expertise in Pet Domain can be in form of Doctor, trainer, breeder, groomer or Dog Shelter organizations. The real challenges are to recognize the problem scenario, understand the user, data and the environment, taking care of feasibility and then giving the novice user, the best fit solution for his pet. The goal is requirement analysis for best fit search foraying in array of choices of this ever changing E-world and Recommendation architecture which provides contemporary problems in every search engine and recommendation system's research. This paper addresses all this and assists the user to find their requirements easily and undermine the information overloading as well as over specialization problems along with other recommendation issues.

**Keywords :** Expert finding systems; Knowledge discovery; Recommendation systems; Information Systems; Expert locating systems; Pet recommendation systems; Pet Finding systems; Vet locating systems; Vet Finding Systems.

## 1 INTRODUCTION

PEOPLE in organizations try to solve their problems to get their work accomplished. To do so, they often must find others with knowledge and information. Systems that assist users with finding such expertise are increasingly interesting to organizations and scientific communities [1]. When a novice needs help, often the best solution is to find a human expert who is capable of answering the novice's questions. But often, novices have difficulty characterizing their own questions and expertise and finding appropriate experts. Previous attempts to assist expertise location have been provided by famous matchmaking services, but they ignore the task of classifying knowledge and queries, as a result has to be performed manually by the participants [2]. Computerized systems that augment the process of finding the right expert for a given problem, in an organization or world-wide, are becoming famous. Expert discovery is a quest in search of finding an answer to a question: "Who is the best expert of a specific subject in a particular domain within a peculiar array of parameters?" Expert with domain knowledge in any fields is crucial for consulting in industry, academia and scientific community. Collaboration with expertise is critical requirement in business corporate, such as in fields of engineering, geographies, bioinformatics, and medical domains [3]. This work is an Expert Finding System in Pet domain – a unique and rarely explored field of designing a Dog Portal. Expert finding is novel but evolutionary and mushrooming area with an extension to recommendation and other search engine Analogies. Earlier works [1-4] used standard Information Retrieval (IR) techniques to locate an expert on a given topic. In these works, a person's expertise was described as a term vector and the result was a list of related people. More recently, the Enterprise Track at the Text Retrieval Conference (TREC) was created to study expert finding. Participants in that track have investigated numerous methods, including probabilistic and language modeling techniques [4]. Our goal here is to find best-fit expert recommendation for the various queries of a dog lover or owner such as

for medication, grooming, training etc. The research filters the abstract knowledge crawled from web as per the user, data and environment of context. The approach also does requirement analysis of the user and expert to match their knowledge levels. The maturation effect of environment hits hard on context of every environment in this infinite ocean of research alternatives. Also Environment context has the problems of changing needs of the people. People context has the problem of availability and efficiency. Lastly Data context has the problems of authenticity and scalability. So this expert recommendation research is highly infinite, circular and dynamic in nature leading to is no viable one stop solution. So, the focus will be on calculating the balancing point of the three parameters – Environment, People and Data and then accordingly develop the best fit expert finding algorithm. This work is divided into 6 more parts. Part 2 talks about Current Open problems in expert finding systems, Part 3 talks about Literature review of related work, Part 4 to 6 presents the overall architecture with testing, and its discussion is rolled up with Conclusion at last in part 7.

## 2 CURRENT OPEN PROBLEMS

Expert finding is a difficult task because experts and their skills and knowledge are rare, expensive, (unevenly) distributed, difficult to qualify, continuously changing, varying in level, and often culturally isolated and oversubscribed. To complicate this, expert seekers typically have poorly articulated requirements, are ignorant of expert's past performance, and are not fully enabled to judge a good expert from a bad one.

1) How can expertise indicator sources in organizations be identified and exploited?
2) How should expertise and expert models be structured and represented?
3) How should one apply inference rules and algorithms on expert and expertise relationships?
4) How should users be supported in searching, visualizing and analyzing the expertise information space?

5) How to measure Knowledge Level and Comfort Level of Expert and End user to calculate Adaptability index? [The most pivotal point]
6) How to relate Knowledge Management, Recommendation systems, Web Engineering to find relevant expert Knowledge?
7) How to co-relate and bind Knowledge Discovery, Knowledge Presentation, Knowledge sharing in Overall Knowledge Management Grid to find best fit experts in Pet Domain ?

## 3 LITERATURE REVIEW OF CURRENT EXPERT FINDING SYSTEMS.

Expert Finding Systems (EFS), also called Expertise Location Systems (ELS) enable users to discover subject matter experts in order to hire or acquire their knowledge. EFS can make organizations more efficient and effective by rapidly locating individuals or communities of expertise to accelerate research and development, enable rapid formation of operational or proposal teams, or support formation of cross disciplinary teams to respond to new market threats and opportunities. EFS can also be used to assess enterprise skill sets, enabling the identification of skill atrophy, the discovery of new and emerging skill areas, or the prediction of the effects of skill loss (e.g., as a result of attrition or retirement) or gain (e.g., as a result of a merger or acquisition). After analyzing the works [1-15], there are some inferences and observations quoted below. EFS need to support a number of key requirements including the ability to:

1) Identify experts via self-nomination and/or automated analysis of expert communications, publications, and activities.
2) Classify the type and level of expertise of individuals and communities.
3) Validate the breadth and depth of expertise of an individual.
4) Recommend experts including the ability to rank order experts on multiple dimensions including skills, experience, certification and reputation.

Successful deployments of EFSs require executive championship, involved users, user/culture cantered design, clear purpose, realistic goals, measured usage and benefit, simplicity, ease of use, incremental deployment, appropriate privacy, incentives for use, and effective marketing, communication, and training.

### Requirements

Those in need typically have little or no means of finding experts other than by recommendation. At the other end, busy experts do not have time to maintain adequate descriptions of their continuously changing specialized skills. Past experience with "skills" databases indicates that they are difficult to maintain, quickly outdated, and reflect self-reporting biases. What is required is an ability to support the following functions with respect to experts:

**Identify:** Cull through explicit (self) nominations and/or large collections of artefacts (email, instant messages, documents, briefings) created by individuals to implicitly determine candidate experts in a given topic.

**Classify:** Assess multiple sources of evidence to characterize the type and level of expertise of individuals. Analyze competencies and relationships among experts to determine communities of interest and communities of practice.

**Validate:** Assess the breadth and depth of expertise of an individual to verify their expertise level. Expertise qualification can be done by human assessment, marshalling evidence (e.g., qualifications, resume, publications), or automated user feedback mechanisms (e.g., positive and negative feedback from interactions to establish reputation.).

**Rank:** Produce a rank order of experts on particular dimensions (e.g., years of experience, type of experience, certifications, publications, etc).

**Recommend:** Given a particular information need and importance criteria (e.g., breadth vs. depth, types of experience), return a rank order list of experts or expert communities that are most relevant to the need.

### Challenges in Expert Finding Systems:

1) Expert finding is challenging for many reasons including:
2) The volume of communication/publication is no indication of expertise.
3) The first expert you find may not be best one.
4) Certain topics engender more opinion than facts and so finding the true expert can be difficult.
5) There generally is a lack of access to information about past performance of experts.
6) New employees don't know about informal social networks hence cannot exploit these to find experts.
7) Privacy concerns may limit the degree to which measurements of expert performance is shareable.
8) Expertise is not distributed evenly and strengths of associations among experts vary significantly.
9) There are no standards specifying the criteria and/or qualifications necessary for particular levels of expertise.
10) True expertise is rare and expensive. Often access is controlled, either informally or formally, either by the expert themselves or their management.
11) Expertise continuously changes and requires awareness of this dynamic.
12) Solutions to complex problems often require either communities of experts or diverse ranges of expertise that need to be brought together to solve the complex problems.
13) Engineers in one classic study spent 16% of their time communicating with experts – but communication was impeded by geographic, time difference, and cultural barriers.
14) Performance Measures: Some of the points come into picture for valid performance measures with respect to expert finding systems are given below [5].
15) Expert Disclosure: Does the appearance of expert finding services encourage experts to publish expert profiles or their expert content?
16) Time: How quickly can individuals find experts or expert knowledge sources?
17) Knowledge Searching: Does the availability of an expert finder increase the amount of knowledge discovery events by end users because they believe they can find answers to their knowledge needs?
18) Knowledge Stewardship: Does the designation of experts or their increased visibility to staff encourage knowledge sharing?
19) Enterprise Awareness: The insight the enterprise gains

into its staff competencies in terms of areas of expertise, size and depth of staff in those areas Abbreviations and Acronyms

## 4 OVERVIEW OF PROPOSED SOLUTION.

Expert Finding Systems are gaining focus in Universities, HR, Medical and Project Management systems. These systems give futuristic directions to recommendation systems, Information systems and Knowledge Management. Be it searching for an answer or troubleshooting a problem, an expert is required in every application domain. The process is to look for best-fit expert to solve end user's problem. Information Systems and Knowledge Management can take care of information processing. Recommendation system can recommend list of choices that is precompiled but is affected by change in context and Human maturation Effect. But Expert finding systems aim to give relevant answer of the pertinent problem. We are trying to find experts in pet domain – specifically for dogs. Our goal is to find best-fit expert for the various queries of a dog lover or owner – for medication, grooming, training etc. As this research work is infinite, circular and dynamic, there is no viable solution. So, our focus will be on calculating the central point, the balancing point of the three parameters – Environment, People and Data and then accordingly develop our algorithm. Environment context has the problems of changing needs of the people. People context has the problem of availability and efficiency. Lastly Data context has the problems of authenticity and scalability. Firstly, we will be getting our knowledge base by crawling various sites to extract relevant information corresponding to our requirements – dog breeds, veterinary doctor profiles, groomers, trainers to make our database. We will also be taking into account the availability factor of these vets. This is will be our whole knowledge base on which we will apply various filtering conditions to serve the query of the user in the best possible way. Then we will develop our algorithm for finding best-fit experts on the basis of qualification, experience and availability, pertaining to the contextual parameters. Algorithm will also try to take into account the adaptability level which includes social and knowledge level. We will try to give the best-fit solution in our algorithm trying to balance all the three problem areas – Environment, People and Data. Querying is made easy and convenient through knowledge map representation. Comparison with other approaches is depicted by the Fig. 1. given below:

**Comparisons with existing approaches**

| | Our Approach | Existing Approaches |
|---|---|---|
| 1. | Multi-dimensional context capturing. | Context is not well measured. |
| 2. | Focus on intelligent data. | Focus on active or dynamic data. |
| 3. | All the three context parameters are considered – Data, People and Environment. | Not all are considered while providing solution |
| 4. | Find the balancing point of the three parameters simultaneously to give the solution. | The three parameters are managed individually, not balanced. |
| 5. | Querying through keywords and search strings. | Querying in whole problem format. |
| 6. | Maturation Effect is not considered | Is Considered |
| 7. | Knowledge Mining is not done. | Knowledge-Map or Knowledge synthesis is not done to an optimum level. |
| 8. | NIL | Weight to requirement analysis than presence of unrequited resources. |
| 9. | NIL | Helping in Understanding the problem and problem context. |
| 10 | Issues of Novelty, Overspecialization etc | Issues do not come into picture as fresh data according to Knowledge Management is crawled every time. |

**Fig. 1.** *Comparison of Other expert finding systems with proposed approach.*

Conversion of data to Knowledge through knowledge Map: Knowledge builds upon information extracted from data. Data can be termed as the property of things but knowledge is property of agents defining their actions in particular circumstances, whereas information is that subset of data that stimulates an agent to act accordingly. Michael Polanyi had classified knowledge as of two types, explicit and tacit where explicit knowledge can be spoken and codified in words, figures or symbols, typically in documents or databases, tacit knowledge is embedded in individuals' minds and is hard to express and communicate to others. Another division of knowledge was described by cognitive psychologists as descriptive (know-what), procedural (know-how) knowledge and strategic knowledge (know-why, know-when). Descriptive knowledge is also referred to as declarative and is more comparable with the explicit than with the tacit dimension. Descriptive knowledge defines a description of an object, situation, facts or methods and procedures. Procedural knowledge specifies actions or manipulations, for example, steps to fulfill a task, process to gain a skill. Instead of facts, it describes a method or behaviour. Strategic knowledge is rarely measured and is invoked when other knowledge types are used. An individual benefits from using strategic knowledge in a decision process. It can be considered as a subset of declarative knowledge. Human intentions related to know-why type of knowledge also belong to the group of strategic knowledge.

## 5 THE ANALYSIS DESIGN AND MODELLING OF BEST FIT EXPERT FINDING APPROACH.

Firstly, we will be building our knowledge base by crawling various sites to extract relevant information corresponding to our requirements – dog breeds, veterinary doctor profiles, groomers, trainers to make our database. We will then, download the data, parse it, convert to relevant form and apply filtering conditions for making the data intelligent so that then we store it for efficient user results through user-querying and knowledge map. This will be our whole knowledge base on which we will apply various filtering conditions to serve the query of the user in the best possible way. We will try to give the best-fit solution in our algorithm trying to balance all the three problem areas – Environment, People and Data. Environment area has the problems of changing needs of the people. People area has the problem of availability and efficiency. Lastly Data area has the problems of authenticity and scalability. As this research work is infinite, circular and dynamic, there is no viable solution. The solution changes with time, context, people, domain etc. It may not give new results or solutions due to the interdependency and dynamicity of the problem areas. After having handled the problems areas we, then will develop our rating algorithm for experts on the basis of qualification, experience, availability and feedback, pertaining to the contextual parameters. Algorithm will also try to take into account the adaptability level which includes social and knowledge level. To make it available to the end-users, we will develop the user-interface, a portal which will help us to integrate the back-end work with the front-end, for easy and efficient user-querying. Finally, we will do the testing for accuracy and efficiency of our proposed Expert Finding System.

**Functional and Non functional requirements for best Fit Expert Finding Process are as follows:**

**Functional Requirements:**
Functions can best be represented from the actor's perspective in the form of use cases. In the tables that follow, the requirements are listed with their applicable use cases. However, first the actors, their roles and their applicable use cases will be addressed. The actors in this system are few. Following actors are involved in this system:
1) User(for testing)
2) End User
3) System Administrator

**Actor 1:** User (for testing): These users will be helping in testing purpose. They are little trained, firstly they will query system by writing only keywords for one or two fields which are easily searchable by system then, they will write for all the fields so that overall accuracy can be calculated.
**Actor 2:** End User: They are one who doesn't know any technical thing. So they will only write queries in the form of keywords or search strings and system had to search for relevant solution.
**Actor 3:** System Administrator: Administrator is the one who is responsible for every work in the system. Firstly to collect the Database for experts in usable manner by crawling the Web. Then to filter the result for best fit solution by using the algorithm.

**Non Functional Requirements:** Let us see the Software System attributes of this proposed solution.
20) Correctness: Dog portal must be correct to the extent that it satisfies all the requirements of a Query.
21) Interoperability: Portal interaction with the database should be correct so that it returns correct and efficient results.
22) Maintainability: Portal must be maintained time to time as the database needs updation with time, otherwise data will become obsolete. This attribute can be measured by the number of hours that must be spent per year fixing and maintaining the software.
23) Portability: There is no required for this system to be portable. The system will give results on the browser, so it will be browsers duty to be portable with every system.
24) Reliability: The portal must be available to the users every time so that they can use it with ease. Major bugs, affecting the software operation or the integrity of stored data are unacceptable.
25) Survivability: The system shall support backup onto Hard disk so that data can be stored off site, and old data can be archived and removed from the system.
26) Usability: System working should be easily available to the end user and will not require any training to use it or to navigate through it.

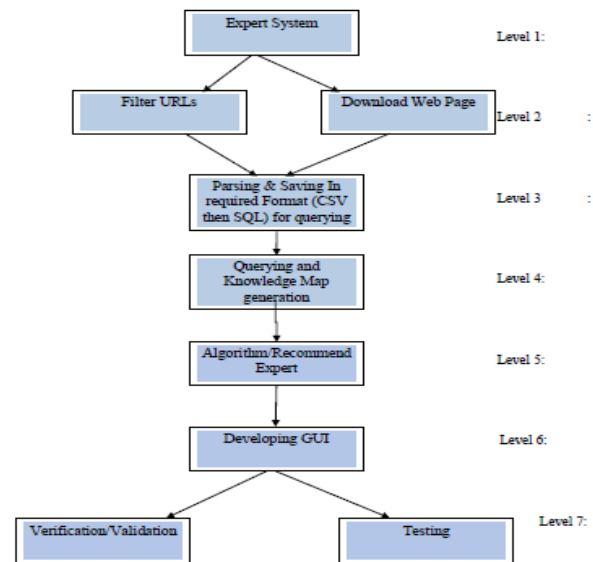The goal and work flow is depicted by Fig. 2. and Fig. 3. given below.



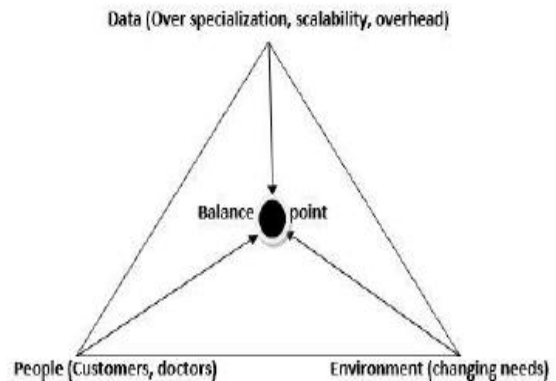**Fig. 2.** *The Process Flow of Best fit expert solution for Dog's Domain.*



**Fig.3.** *The Best Fit Expert Recoomendation Feasibility Prism*

## CONVERTION OF DATA TO KNOWLEDGE THROUGH KNOWLEDGE MAP

In this work, the data that si the experience or expertise, way of handling queries, archive sessions of expert-user transactions, feedback of users, ratings, every such commodity needs to be harnessed for best fit recommendations or finding and expert for the end user query. In processing of this architecture we need to understand the basic process of Knowledge Map and Knowledge Profiling. Knowledge builds upon information extracted from data. Data can be termed as the property of things but knowledge is property of agents defining their actions in particular circumstances, whereas information is that subset of data that stimulates an agent to act accordingly. Michael Polanyi had classified knowledge as of two types, explicit and tacit where explicit knowledge can be spoken and codified in words, figures or symbols, typically in documents or databases, tacit knowledge is embedded in individuals' minds

and is hard to express and communicate to others. Another division of knowledge was described by cognitive psychologists as descriptive (know-what), procedural (know-how) knowledge and strategic knowledge (know-why, know-when). Descriptive knowledge is also referred to as declarative and is more comparable with the explicit than with the tacit dimension. Descriptive knowledge defines a description of an object, situation, facts or methods and procedures. Procedural knowledge specifies actions or manipulations, for example, steps to fulfill a task, process to gain a skill. Instead of facts, it describes a method or behavior. Strategic knowledge is rarely measured and is invoked when other knowledge types are used. An individual benefits from using strategic knowledge in a decision process. It can be considered as a subset of declarative knowledge. Human intentions related to know-why type of knowledge also belong to the group of strategic knowledge.

### Knowledge Mapping:

An ongoing joint quest to help discover the constraints, assumptions, location, ownership, value and use of knowledge assets, artifacts, people and their expertise, uncover blocks to knowledge creation, and find opportunities to leverage existing knowledge. Knowledge mapping may involve developing an ontology, conducting social network analysis, executing a survey, engaging a group of people in sense-making, action research or ethnography. The process of making the knowledge map is as important as the final product because it's impossible to create a single map which will meet the needs of every situation. Agreement is required by decision-makers regarding the purpose of the knowledge mapping exercise and a map or maps created to meet those objectives. Knowledge mapping is data gathering, survey, exploring, discovery, conversation, disagreement, gap analysis, education and synthesis. It aims to track the loss and acquisition of information & knowledge, personal and group competencies and proficiencies, show knowledge flows, appreciate the influence on intellectual capital due to staff loss, assist with team selection and technology matching. Knowledge Mapping is a process of surveying, assessing and linking the information, knowledge, competencies and proficiencies held by individuals and groups within an organization. Vail et.al defined a knowledge map as a visual display of captured information and relationships, it's an association of items of information such that association itself create actionable information. These maps enable efficient and effective communication of knowledge at multiple levels of detail, by observers with different backgrounds. According to Ong et al a knowledge map is a knowledge representation technique that reveals the underlying relationships of the knowledge sources using a map metaphor for visualization, thus it is a technique that can be used by organizations to identify their intellectual assets of the knowledge domain. The process of building knowledge maps entails creation of ontology, identification of processes and extracting the instances of a process. Different types of knowledge is then extracted and represented as knowledge maps. The knowledge maps are subsets of the ontology and can be used as an analytical tool in the decision-making process. Large research has been done on designing of knowledge map and different researchers had characterized them on different criteria. Eppler categorized knowledge maps as source maps, knowledge asset maps, knowledge structure maps, knowledge application maps and knowledge development maps. Besides these five types of knowledge maps, one can also imagine knowledge map that combines some of the above types into a single map, typically, a knowledge application map and a partial source map. Implementation of popular knowledge mapping tools and techniques like Concept map, Mind Map /Idea map, Concept circle diagram, Semantic map, Cognitive map, Process map, Social mess map / Cross boundary causality map, Conceptual map, Knowledge flow map, Causal map, Cluster Venn diagram, Thesauri, Topic map, Perceptual map for higher.

### Knowledge Profiling:

The profile of an individual is a record of the types and areas of skills of that individual ("topical profile") plus a description of her collaboration network ("social profile"). In existing expert finding systems, profiles are constructed from sources such as email or documents, and used as the basis for expert identification.

## 6 THE IMPLEMENTAION OF BEST FIT EXPERT SEARCHING

We are crawling the user query data according to the matching strings like dog breeds, vets etc. We have made a basic web-crawler for searching the web. With this, we can enter search criteria and then search the web in real time, URL by URL, looking for matches to the criteria. The search can be additionally tweaked by choosing to limit the search to the site of the beginning URL. The matches section at the bottom of the window has a table listing all the matches found by our search. These are the URL of the web pages that contain the search string. Next, we are downloading the webpages and storing them locally for parsing according to the search string. It is then converted in csv format for storing in SQL database. Next the user can queries according to the relevant search strings or keywords corresponding to his/her problem for solution. Knowledge map is also generated. Afterwards, the result is displayed.

1) Novelty: As this research work is infinite, circular and dynamic, there is no viable solution. So, our focus will be on calculating the central point, the balancing point of the three context parameters – Environment, People and Data and then accordingly develop our algorithm. In previous researches, these three are not balanced simultaneously. This is the novelty of our project. Environment context has the problems of changing needs of the people. People context has the problem of expertise changes, availability and efficiency. Lastly Data context has the problems of authenticity, overhead, over-specialization and scalability. Our approach is such that it gives the best response handling the problems/concerns of all the three parameters simultaneously.

2) Functionality: Computer systems that augment the process of finding the right expert for a given problem in an organization or world-wide are becoming feasible more than ever before. Our System provides the user with grooming, training etc. The Knowledge map helps the user to further visually generating the required results.

3) Complexity: We are first harnessing the algorithm as matching the Knowledge required by the End user with the Knowledge Level of Expert is inexplicable. Feedback generation will also be considered while developing algorithm.

4) Quality: Since we have tried to handle all the three prob-

lem areas simultaneously – crawled relevant data, parsed, filtered, and formatted then applied our model through java programming, our approach will be highly effective.

5) In the algorithm, firstly we took details from user for better recommendation.

6) Profession of user which will enable us to understand user better, we can recommend them the doctor which is less experienced or more experienced according to their pay.

7) Location: It is most important aspect of user, as it will be of no use if we recommend an expert who is far from the user's home. So more importance given to the location of user's home.

8) Breed: Dog breed is of much importance, we categorize dogs according to their species in three categories: easily available, normal, rare. Then gave rating according to their category, so that user does not had to pay more for a normal breed. For this we used expert experience level by their age group.

9) Degree: If user had good knowledge about experts then he or she can ask for an expert with a specific degree to specialize their search more.

10)   At last by collecting all these values and giving weight age to the user preference by our algorithm, we try to recommend best possible and available expert to the user. The following system snapshots give the implementation details. The figure 4 depicts the results of implementation.

The working of the Architecture is depicted by the following given snapshots of implementation depicted by Figure 4.



Dog products:





Knowledge Map:



**Fig. 4.** *The best fit expert search model for Dog's domain, the implementation stages.*

## 7   CONCLUSION

Expert finding is a difficult task because experts and their skills and knowledge are rare, expensive, (unevenly) distributed, difficult to qualify, continuously changing, varying in level, and often culturally isolated and oversubscribed. To complicate this, expert seekers typically have poorly articulated requirements, are ignorant of expert's past performance, and are not fully enabled to judge a good expert from a bad one. Expert discovery is a quest in search of finding an answer to a question: "Who is the best expert of a specific subject in a particular domain within a peculiar array of parameters?" Expert with

domain knowledge in any fields is crucial for consulting in industry, academia and scientific community. Aim of this study is to address the issues for expert-finding task in real-world community. Collaboration with expertise is critical requirement in business corporate, such as in fields of engineering, geographies, bio-informatics, and medical domains While working on this research, it was realized that this research is infinite, circular and dynamic, one needs to take a lot of factors into consideration for obtaining a viable solution; factors like adaptability level, social level, knowledge level etc. Thus, we tried to provide an optimum solution taking into the three risk factors – Data, People and Environment. We are solving the end-user querying by crawling relevant data and updating it according to the requirement and making our data intelligent through content filtering. Then we provide the user with solutions according to his/her search criteria. Also, knowledge map is generated for better comprehension for the user. Finally, we recommend the optimum expert according to our algorithm out of the possible solutions. Handling the limitations and future work of our approach can make our system better. are solving the end-user querying by crawling relevant data and updating it according to the requirement and making our data intelligent through content filtering. Then we provide the user with solutions according to his or her search criteria. Also, knowledge map is generated for better comprehension for the user. Finally, we recommend the optimum expert according to our algorithm out of the possible solutions. Handling the limitations and future work of our approach can make our system better.

## ACKNOWLEDGMENT

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