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OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

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APPENDIX/ANNEXURE

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, KurukshetraUniversity, Kurukshetra.

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- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

K-JOIN-ANONYMITY FOR DATABASE ON DATA PUBLISHING

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ABSTRACT

Privacy for microdata is common problem in external database and data publishing. K-anonymity is one technique to protect micro data against linkage and identification of records. While in previous k-anonymity algorithms exist for producing k-anonymous data, due to privacy issues, the common data from different sites cannot be shared directly and assumes existence of a public database that can be used to breach privacy. During anonymization process, public database are not utilized. In existing generalization algorithm creates anonymous table by using microdata table. Omission of public database leads to a high information loss. So we introduce new concept k-join-anonymity (KJA) that reduces information loss while publishing data and it is more effective generalization. KJA permits utilization of existing generalization techniques. In KJA, we adapt k-anonymity algorithm proposing two methodologies. First generalizes combination of micro data table and public database under the constraint that each group should contain at least one tuple of microdata table. In second anonymizes micro data table then refines the resulting groups using public database.

KEYWORDS
Microdata, Privacy, k-anonymity, k-join-anonymity.

1. INTRODUCTION

Many organizations are increasingly publishing microdata tables that contain unaggregated information about individuals. These tables can include medical, voter registration, census, and customer data. Microdata is a valuable source of information for the allocation of public funds, medical research, and trend analysis. However, if individuals can be uniquely identified in the microdata, then their private information (such as their medical condition) would be disclosed, and this is unacceptable. Microdata are useful for several tasks such as health research etc., Privacy for microdata aims at limiting the risk of linking published data to a particular person [1]. There are three types of microdata attributes are relevant to the privacy preservation. They are

1. Identifiers (IDs)
2. Quasi Identifiers (QIs)
3. Sensitive attributes (SAs)

IDENTIFIERS
Attributes like Name, Social Number or License Number that uniquely identify individuals
QUASI-IDENTIFIERS
Attributes like Age, Gender and Zip Code which exist in other existing external databases and may be used by combination to identify an individual that are named quasi identifier.
SENSITIVE ATTRIBUTES
Attributes like Income of Bank Customers or Disease of Hospital Patients that are important for data holder to remain private for individuals and they are named sensitive attributes.
EXAMPLE 1

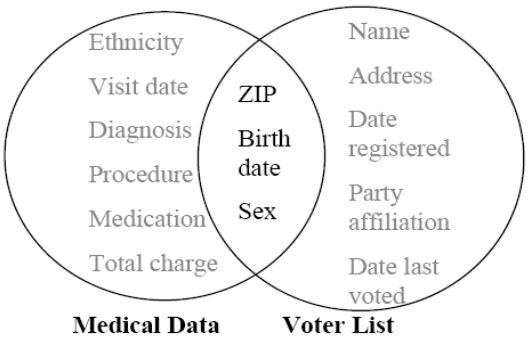
Identifier	Quasi Identifiers			Sensitive
Name	Birthdate	Gender	Zipcode	Disease
Arun	21/1/79	Male	637202	Flu
Marry	10/3/81	Female	637201	Hepatitis

Several concepts have been proposed to achieve privacy preservation. Most database literature has focused on k-anonymity [8], [10]. Specifically, a table T is k-anonymous if each record is indistinguishable from at least k-1 other tuples in T with respect to the QI set. The process of generating a k-anonymous table given the original microdata is called k-anonymization. The most common form of k-anonymization is generalization, which involves replacing specific QI values with more general ones.
The concept of K-join-anonymity permits the utilization of existing generalization techniques and protects the microdata against the linkage and identification of records during the data publishing.

2. PROBLEM DEFINITION

All the previous k-anonymity techniques are not utilizing the existence of a Public Database during the anonymization process. This omission leads to unnecessarily high information loss. Grouping the fields that contain tuples with different quasi identifiers values. Publicly available databases (voter lists, city directories) can reveal the “hidden” identity [2], [3]. Attacker can re-identify the sensitive information by using background knowledge. By using micro data table alone its create the anonymous table. Not utilizes the Public Database for generalization algorithm[5]. Sensitive attributes are not consider while data publishing. Attacker have the Background Knowledge about microdata by using public database (example: voter list, city directory). Unnecessarily high information loss.

EXAMPLE 2



In the above example attacker use the public database (voter list) to know the details of the microdata like medical data. By using background knowledge attacker know the privacy data. In the existing system there is possible for information leakage and data linking and identification problem. In this anonymous table created for microdata table alone.

To avoid the identification of records in microdata, uniquely identifying information like names and social security numbers are removed from the table. However, this first sanitization still does not ensure the privacy of individuals in the data. A recent study estimated that 87% of the population of the United States can be uniquely identified using the seemingly innocuous attributes gender, date of birth, and zip code [9]. In fact, those three attributes were used to link voter registration records (which included the name, gender, zip code, and date of birth) to supposedly anonymized medical data (which included gender, zip code, date of birth and diagnosis). This "linking attack" managed to uniquely identify the medical records of the individual [10].

2.1. ATTACKS ON *K*-ANONYMITY

In this section we present two attacks, the **homogeneity attack** and the **background knowledge attack**.

Observation 1. *k-Anonymity can create groups that leak information due to lack of diversity in the sensitive attribute.*

Observation 2. *k-Anonymity does not protect against attacks based on background knowledge.*

3. RELATED WORK

Definition 1. (Quasi-identifier)**.** *A set of nonsensitive attributes* $\{Q_1,\ldots,Q_w\}$ *of a table is called a* quasi-identifier *if these attributes can be linked with external data to uniquely identify at least one individual in the general population.*

One example of a quasi-identifier is a primary key like social security number. Another example is the set {Gender, Age, Zip Code}in the Group Insurance Company dataset that was used to identify the governor of Massachusetts as described in the introduction. Let us denote the set of all quasi-identifiers by *QI*. We are now ready to formally define *k*-anonymity.

Definition 2. *The schema of a microdata table (MT) consists of the unique ID, QI and sensitive attributes.*

Definition 3. *The schema of a public database (PD) consists of the unique ID and all QI attributes appearing in MT.*

Using PD, the attacker identifies the QI values of an individuals.

The concept of K-anonymity utilization of existing generalization techniques and protects the microdata against the linkage and identification of records during the data publishing. Anonymized table (AT) is created by using microdata table and not utilizing public database. Identifiers and sensitive information are removed and generalization is performed in the AT.

Sets of attributes (like gender, date of birth, and zip code in the example above) that can be linked with external data to uniquely identify individuals in the population are called *quasi-identifiers*. To counter linking attacks using quasi-identifiers, Samarati and Sweeney proposed a definition of privacy called *k-anonymity* [8,10] A table satisfies *k*-anonymity if every record in the table is indistinguishable from at least *k ¡*1 other records with respect to every set of quasi-identifier attributes; such a table is called a *k-anonymous* table. Hence, for every combination of values of the quasi-identifiers in the *k*-anonymous table, there are at least *k* records that share those values. This ensures that individuals cannot be uniquely identified by linking attacks.

It propose the privacy is common problem while data publishing, formerly, K-anonymity methods of Privacy Protection have great influence on the data precision[6]. This paper also analyzes the reasons of the influence, and proposes an improved algorithm. The algorithm defines a Weight-related of attribute in order to select attributes for generalization. This approach effectively prevents sensitive data loss in the generalization. Experimental results show that the improved algorithm of K-anonymity model increases the data precision effectively.

It proposes and evaluates an optimization algorithm for de-identification of data. This powerful de-identification procedure is known as *k*-anonymization[7]. A *k*-anonymized dataset has the property that each record is indistinguishable from at least *k* – 1 others. In addition, they implemented data-management strategies that avoid repeatedly sorting the entire dataset for markedly reduced node evaluation times. But it does not provide sufficient protection against attribute disclosure.

All the previous work shown the necessity of considering an attacker's background knowledge when reasoning about privacy in data publishing [3]. However, in practice, the data publisher does not know what background knowledge the attacker possesses. Thus, it is important to consider the worst-case.

In [3] this paper, they initiate a formal study of worst-case background knowledge. They propose a language that can express any background knowledge about the data. We provide a polynomial time algorithm to measure the amount of disclosure of sensitive information in the worst case, given that the attacker has at most k pieces of information in this language. We also provide a method to efficiently sanitize the data so that the amount of disclosure in the worst case is less than a specified threshold.

4. K-JOIN-ANONYMITY

K-join-anonymity permits the utilization of existing generalization techniques and protects the micro data against the linkage and identification of records during the data publishing. Join table is created by using both micro data table and public database. Identifiers and sensitive information are removed from the join table. Reduce the loss of information and provide privacy for micro data by utilizing the public database. The goal of k-join-anonymity is to provide the same privacy guarantees with k-anonymity incurring, however, less information loss. To achieve this, it shrinks the G-boxes using public knowledge about universe (U) tuples. In some applications, the entire U is available to the publisher, e.g., as in the company payroll example. First generalizes the combination of microdata table and public database under the constraint that each group should contain at least one tuple of microdata table. Second anonymizes microdata table, and then refines the resulting groups using public database.

Definition 4. (*k*-join-Anonymity) *A table T satisfies k-join-anonymity if for every tuple* $t \in T$ *there exist k - 1 other tuples* $t_{i1}, t_{i2}, \ldots\ldots, t_{ik-1} \in T$ *such that* $t[C] = t_{i1}[C] = t_{i2}[C] = \ldots\ldots = t_{ik-1}[C]$ *for all* $C \in QI$.

The Anonymized Table *T**. Since the quasi-identifiers might uniquely identify tuples in *T*, the table *T* is not published; it is subjected to an *anonymization procedure* and the resulting table *T** is published instead.

ALGORITHM

TOP DOWN GREEDY ALGORITHM

1. IF |T| ≤ k THEN
2. RETURN;

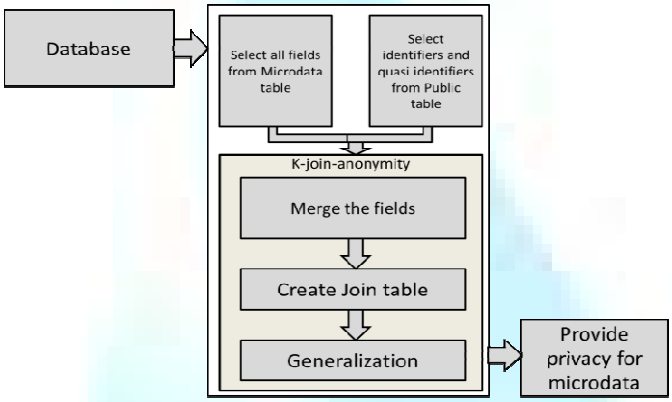
3. ELSE {
4. Partition T into two exclusive subsets T1 and T2 such that T1 and T2;
5. IF |T1| > k THEN
6. recursively partition T1;
7. IF |T2| > k THEN
8. recursively partition T2;
9. }
10. Adjust the groups so that each group has at leastk tuples;

K-JOIN-ANONYMOUS ALGORITHM

1. read quasi-identifier from MT, RT and JT is empty.
2. read quasi-identifier from PT, RT and JT is empty.
3. FOR i=1 to n DO
4. JT=(MT,PT);
5. FOR i=1 to m DO
   a) marked 0 on the Tuple of table T;
   b) read into an Tuple;
   c) FOR j=1 TO m DOto find the Tuple which containthe attribute most close to othertuple;
   d)The Tuple of the smallest mark dowith a generalization, and be integrated into the RT;
   e) Repeat the step 4 until all tuples of JTwere generalized;
6. Output the table of RT.

SYSTEM ARCHITECTURE

FIGURE 1: SYSTEM ARCHITECTURE



Definition 5. *Ananonymized table AT of join table is k-join-anonymous if the mapping of each record in join table is indistinguishable among the mapping of at least k-1 other join table tuples.*

Definition 6. (**Distance between two numeric values**) *Let D be a finite numeric domain. Then the normalized distance between two values* $v_i, v_j \in D$ *is defined as:*

$\delta_N(v_1, v_2) = |v_1 - v_2| / |D|$,

where $|D|$ is the domain size measured by the difference between the maximum and minimum values in *D*.

4.1 THE GENERALIZATION OF ATTRIBUTE VALUES

FIGURE 2.1: ZIP DOMAIN

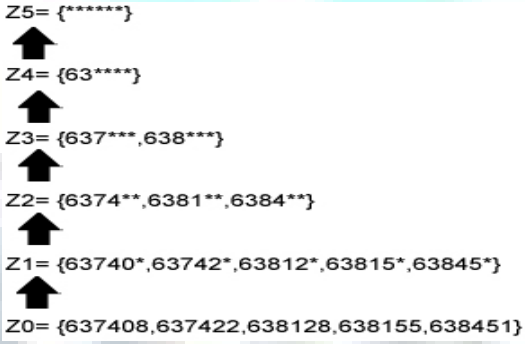
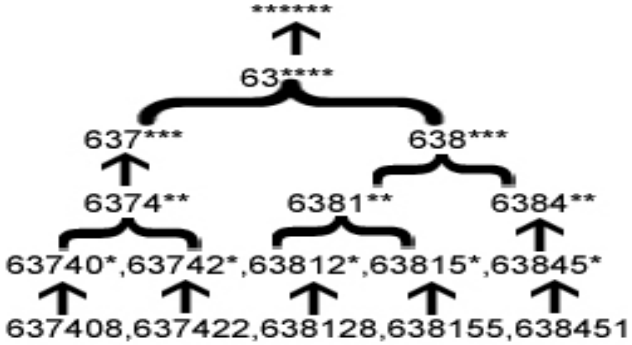
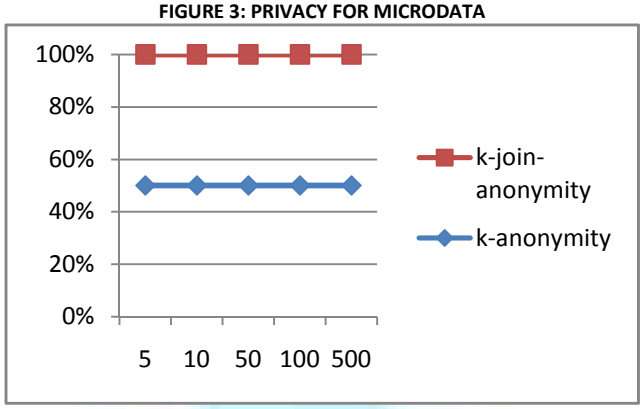


FIGURE 2.2: VALUE GENERALIZATION HIERARCHIES



On a data table, replaced the original value of attribute with another value that can indicate a larger geographical area and have the same semantic, this process is known as a generalization[6]. For example, zip= 637408 can become zip= 63740* and zip=63740* and zip=63742* can become zip=6374**, the generalization value and the original value maintain the right consistency and expand the area represented by the attribute. In relational database system, a domain are used to present of attribute a set of value that attributes assume, in order to facilitate the description of generalization on the attribute, there is need to expand the concept of attribute domain. The original table of data is as specific as possible, but in order to achieve K anonymous, it is necessary to generalize the original data, so reached the level of a more wide. After a generalization, a set of attribute value become a high-level domain. for example, in Figure 2.1 the zip code 637408 is located in the bottom of the domain Z0, generalization of the zip is refers to more widely domain, with Z1 instead of Z0, the operation can be considered from Z0 to Z1 mapping, 637408 → 63740*.

FIGURE 3: PRIVACY FOR MICRODATA



In the Figure 3. Represent the privacy for microdata in k-anonymity and k-join-anonymity. By using k-join-anonymity the information loss will be reduced and utilization of public database, microdata table join table was created and generalization is applied to join table.

5. CONCLUSION

In existing generalization algorithm creates anonymous table by using microdata table. Omission of public database leads to a high information loss. So We introduced new concept k-join-anonymity (KJA), that reduces information loss while publishing data and it is more effective generalization. KJA permits utilization of existing generalization techniques. The privacy for microdata is achieved by using k-join anonymity. In this method, information loss is reduced and public database also taken for anonymization process.

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