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Gomez

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(54) **DATA PRIVACY ENHANCING TECHNIQUE SELECTION**

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(73) Assignee: **SAP SE**, Walldorf (DE)

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G06F 21/60 (2013.01)

(52) **U.S. Cl.**
CPC ***G06F 21/604*** (2013.01); *G06F 2221/2107* (2013.01)

(58) **Field of Classification Search**
CPC G06F 21/604; G06F 21/6245; G06F 2221/2107
See application file for complete search history.

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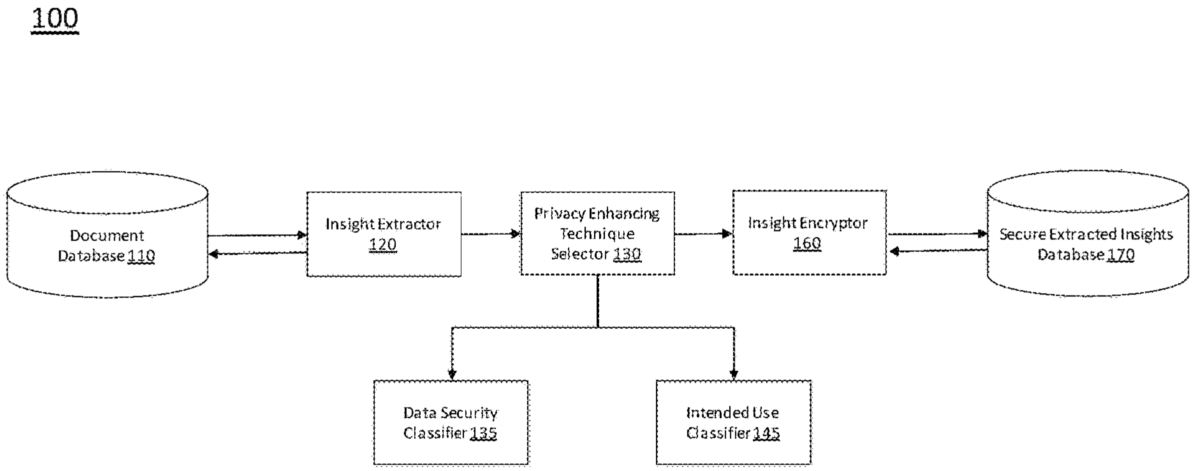
(74) *Attorney, Agent, or Firm* — Sterne, Kessler, Goldstein & Fox P.L.L.C.

(57) **ABSTRACT**

Disclosed herein are system, method, and computer program product embodiments for intended usage driven data privacy enhancing technique selection. An embodiment operates by extracting insights from a document. The embodiment determines a security classification for the extracted insights. The embodiment determining a formula for the extracted insights. The embodiment extracts a processing requirement and a data requirement from the formula for the extracted insights. The embodiment maps a privacy enhancing encryption technique to the security classification and processing requirement for the extracted insights. The embodiment executes the privacy enhancing encryption technique corresponding to the security classification and processing requirement for the extracted insights.

20 Claims, 11 Drawing Sheets


100
Document Database 110
Insight Extractor 120
Privacy Enhancing Technique Selector 130
Insight Encryptor 160
Secure Extracted Insights Database 170
Data Security Classifier 135
Intended Use Classifier 145

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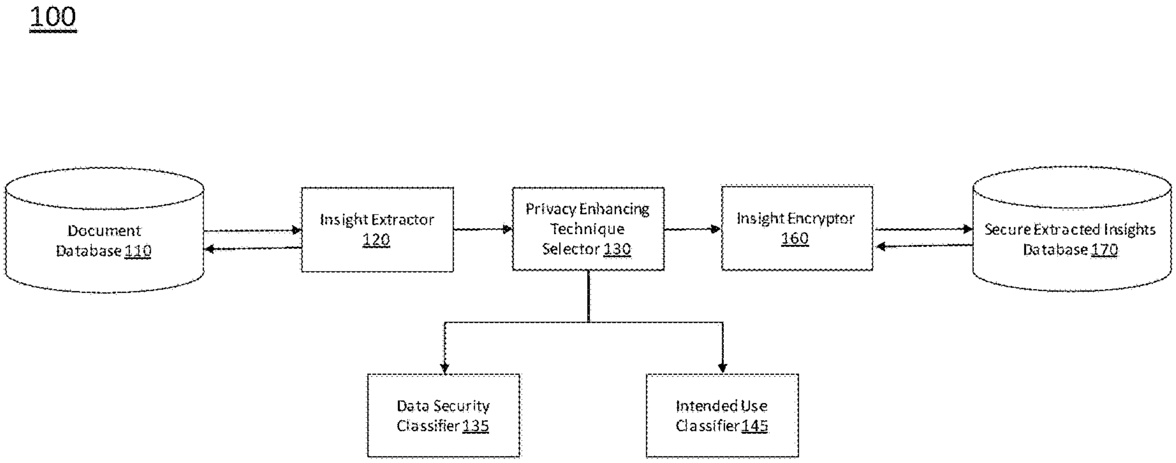

100
Document Database 110
Insight Extractor 120
Privacy Enhancing Technique Selector 130
Insight Encryptor 160
Secure Extracted Insights Database 170
Data Security Classifier 135
Intended Use Classifier 145

Fig. 1

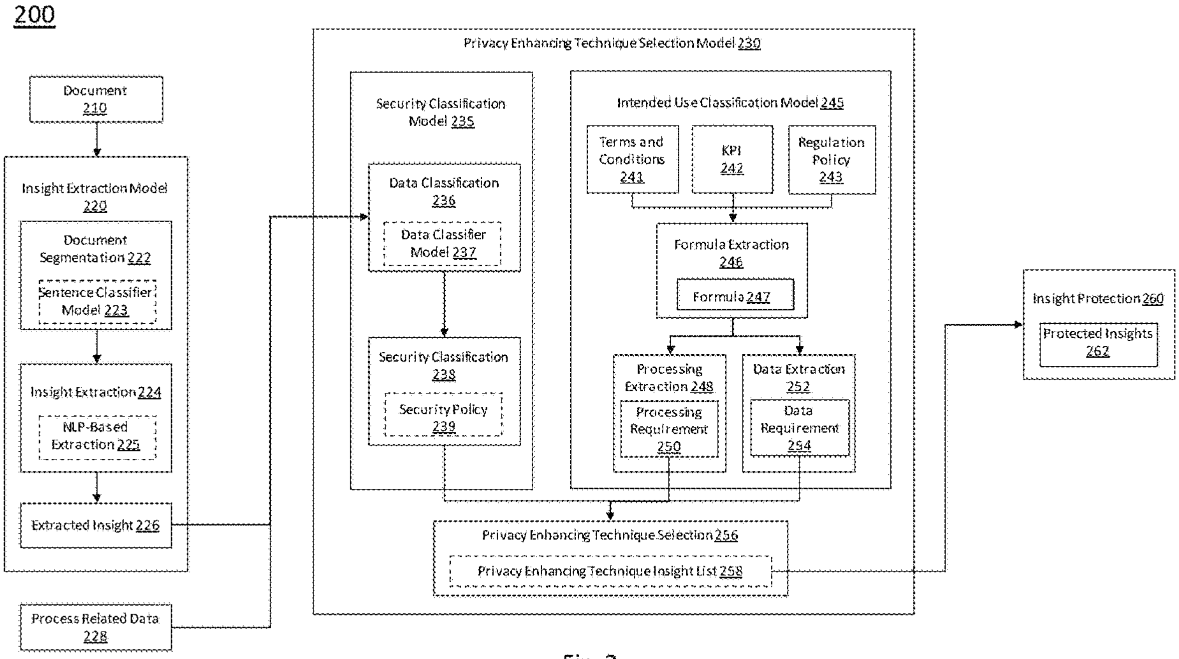
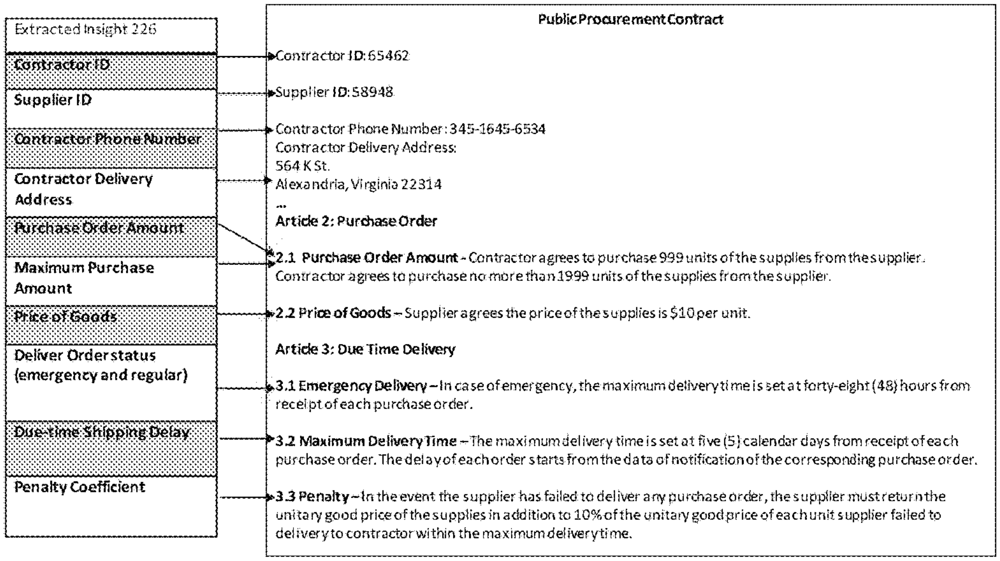

200
Document 210
Insight Extraction Model 220
Document Segmentation 222
Sentence Classifier Model 223
Insight Extraction 224
NLP-Based Extraction 225
Extracted Insight 226
Process Related Data 228
Privacy Enhancing Technique Selection Model 230
Security Classification Model 235
Data Classification 236
Data Classifier Model 237
Security Classification 238
Security Policy 239
Intended Use Classification Model 245
Terms and Conditions 241
KPI 242
Regulation Policy 243
Formula Extraction 246
Formula 247
Processing Extraction 248
Processing Requirement 250
Data Extraction 252
Data Requirement 254
Privacy Enhancing Technique Selection 256
Privacy Enhancing Technique Insight List 258
Insight Protection 260
Protected Insights 262

Fig. 2

300



Public Procurement Contract

Contractor ID: 65462

Supplier ID: 58948

Contractor Phone Number: 345-1645-6534
Contractor Delivery Address:
564 K St.
Alexandria, Virginia 22314
...

Article 2: Purchase Order

2.1 Purchase Order Amount - Contractor agrees to purchase 999 units of the supplies from the supplier. Contractor agrees to purchase no more than 1999 units of the supplies from the supplier.

2.2 Price of Goods – Supplier agrees the price of the supplies is $10 per unit.

Article 3: Due Time Delivery

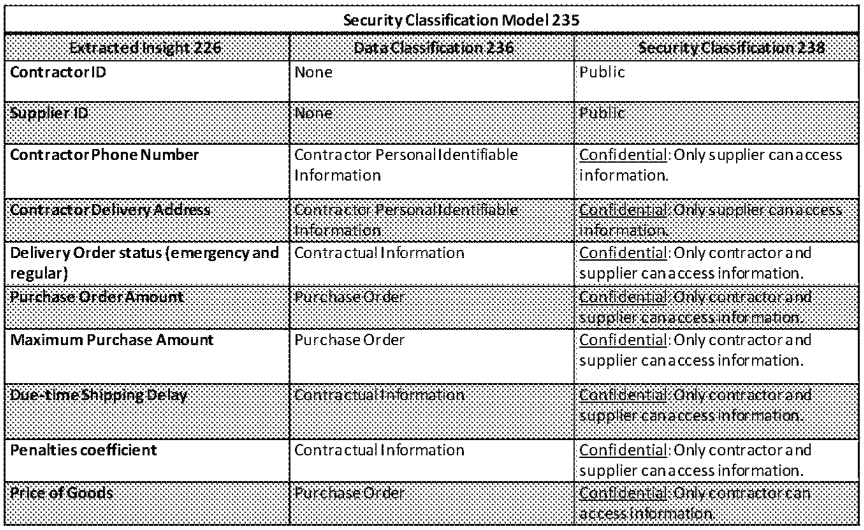
3.1 Emergency Delivery – In case of emergency, the maximum delivery time is set at forty-eight (48) hours from receipt of each purchase order.

3.2 Maximum Delivery Time – The maximum delivery time is set at five (5) calendar days from receipt of each purchase order. The delay of each order starts from the data of notification of the corresponding purchase order.

3.3 Penalty – In the event the supplier has failed to deliver any purchase order, the supplier must return the unitary good price of the supplies in addition to 10% of the unitary good price of each unit supplier failed to delivery to contractor within the maximum delivery time.

Fig. 3

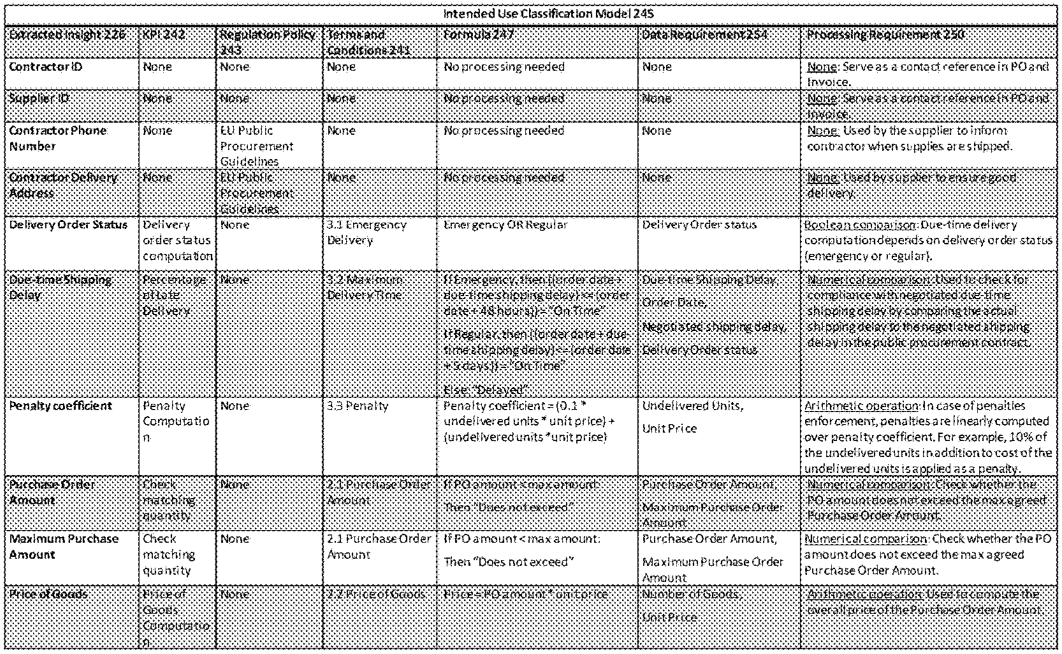
400



Security Classification Model 235		
Extracted Insight 226	Data Classification 236	Security Classification 238
Contractor ID	None	Public
Supplier ID	None	Public
Contractor Phone Number	Contractor Personal Identifiable Information	Confidential: Only supplier can access information.
Contractor Delivery Address	Contractor Personal Identifiable Information	Confidential: Only supplier can access information.
Delivery Order status (emergency and regular)	Contractual Information	Confidential: Only contractor and supplier can access information.
Purchase Order Amount	Purchase Order	Confidential: Only contractor and supplier can access information.
Maximum Purchase Amount	Purchase Order	Confidential: Only contractor and supplier can access information.
Due-time Shipping Delay	Contractual Information	Confidential: Only contractor and supplier can access information.
Penalties coefficient	Contractual Information	Confidential: Only contractor and supplier can access information.
Price of Goods	Purchase Order	Confidential: Only contractor can access information.

Fig. 4

500



Intended Use Classification Model 245						
Extracted Insight 226	KPI 242	Regulation Policy 243	Terms and Conditions 241	Formula 247	Data Requirement 254	Processing Requirement 250
Contractor ID	None	None	None	No processing needed	None	None: Serve as a contact reference in PO and Invoice.
Supplier ID	None	None	None	No processing needed	None	None: Serve as a contact reference in PO and Invoice.
Contractor Phone Number	None	EU Public Procurement Guidelines	None	No processing needed	None	None: Used by the supplier to inform contractor when supplies are shipped.
Contractor Delivery Address	None	EU Public Procurement Guidelines	None	No processing needed	None	None: Used by supplier to ensure good delivery.
Delivery Order Status	Delivery order status computation	None	3.1 Emergency Delivery	Emergency OR Regular	Delivery Order status	Boolean comparison: Due-time delivery computation depends on delivery order status (emergency or regular).
Due-time Shipping Delay	Percentage of Late Delivery	None	3.2 Maximum Delivery Time	If Emergency, then ((order date + due-time shipping delay) <= (order date + 48 hours)) = "On Time" If Regular, then ((order date + due-time shipping delay) <= (order date + 5 days)) = "On Time" Else: "Delayed"	Due-time Shipping Delay, Order Date, Negotiated shipping delay, Delivery Order status	Numerical comparison: Used to check for compliance with negotiated due-time shipping delay by comparing the actual shipping delay to the negotiated shipping delay in the public procurement contract.
Penalty coefficient	Penalty Computation	None	3.3 Penalty	Penalty coefficient = (0.1 * undelivered units * unit price) + (undelivered units *unit price)	Undelivered Units, Unit Price	Arithmetic operation: In case of penalties enforcement, penalties are linearly computed over penalty coefficient. For example, 10% of the undelivered units in addition to cost of the undelivered units is applied as a penalty.
Purchase Order Amount	Check matching quantity	None	2.1 Purchase Order Amount	If PO amount < max amount: Then "Does not exceed"	Purchase Order Amount, Maximum Purchase Order Amount	Numerical comparison: Check whether the PO amount does not exceed the max agreed Purchase Order Amount.
Maximum Purchase Amount	Check matching quantity	None	2.1 Purchase Order Amount	If PO amount < max amount: Then "Does not exceed"	Purchase Order Amount, Maximum Purchase Order Amount	Numerical comparison: Check whether the PO amount does not exceed the max agreed Purchase Order Amount.
Price of Goods	Price of Goods Computation	None	2.2 Price of Goods	Price = PO amount * unit price	Number of Goods, Unit Price	Arithmetic operation: Used to compute the overall price of the Purchase Order Amount.

Fig. 5A

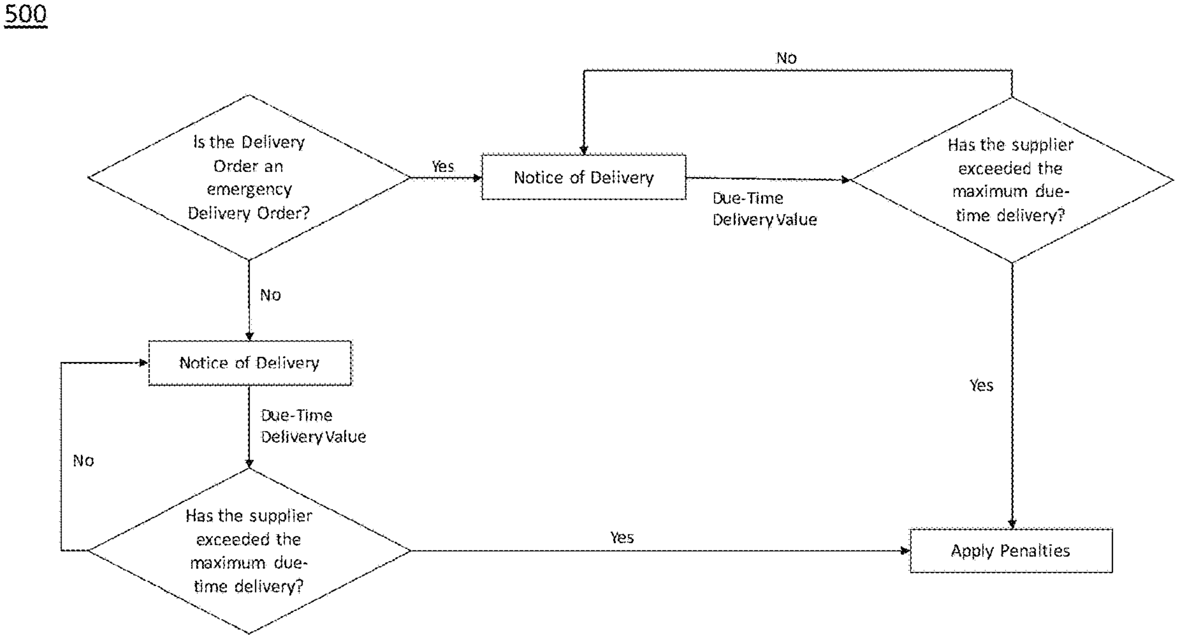

500
Is the Delivery Order an emergency Delivery Order?
Yes
Notice of Delivery
Due-Time Delivery Value
Has the supplier exceeded the maximum due-time delivery?
No
No
Notice of Delivery
Due-Time Delivery Value
No
Has the supplier exceeded the maximum due-time delivery?
Yes
Yes
Apply Penalties

Fig. 5B

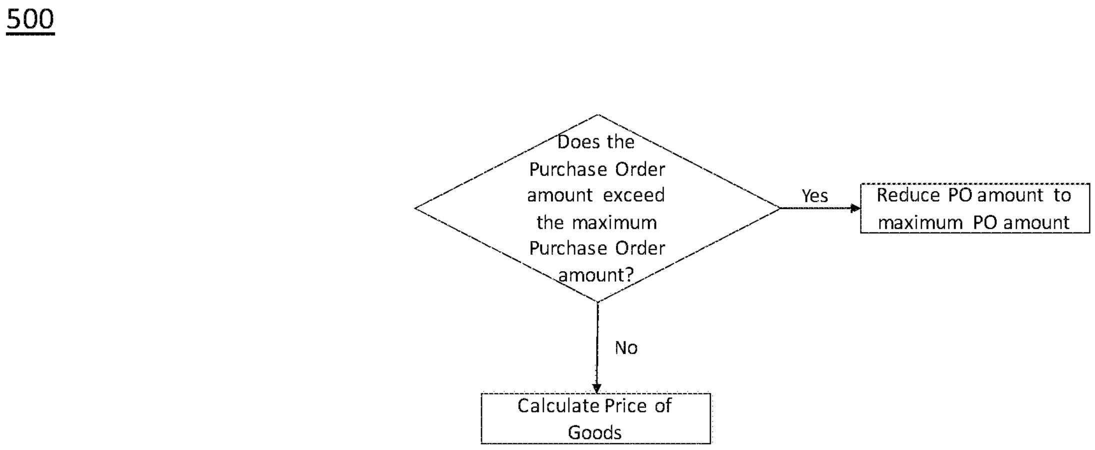

500
Does the Purchase Order amount exceed the maximum Purchase Order amount?
Yes
Reduce PO amount to maximum PO amount
No
Calculate Price of Goods

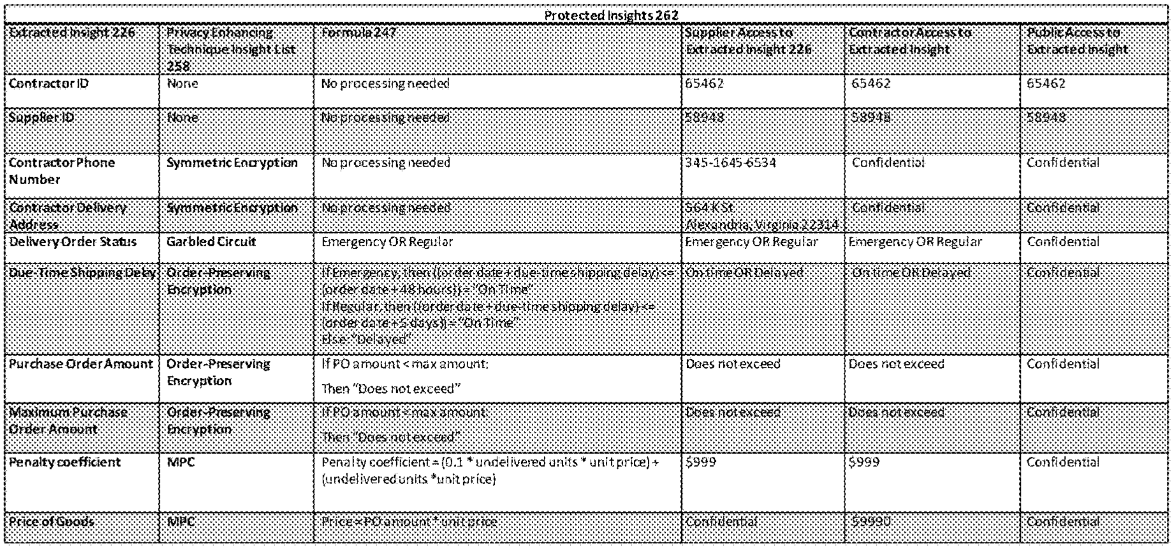
Fig. 5C

600

Privacy Enhancing Technique Selection Model 230				
Extracted Insight 226	**Security Classification 238**	**Data Requirement 254**	**Processing Requirement 250**	**Privacy Enhancing Technique Insight List 258**
Contractor ID	Public	None	None: Serve as a contact reference in PO and Invoice.	None
Supplier ID	Public	None	None: Serve as a contact reference in PO and Invoice.	None
Contractor Phone Number	Confidential: Only supplier can access information.	None	None: Used by the supplier to inform contractor when supplies are shipped.	**Symmetric Encryption**
Contractor Delivery Address	Confidential: Only supplier can access information.	None	None: Used by supplier to ensure good delivery.	**Symmetric Encryption**
Delivery Order status (emergency and regular)	Confidential: Only contractor and supplier can access information.	Delivery Order status	Boolean comparison: Due-time delivery computation depends on delivery order status (emergency or regular).	**Garbled Circuit**
Purchase Order Amount	Confidential: Only contractor and supplier can access information.	Purchase Order Amount, Maximum Purchase Order Amount	Numerical comparison: Check whether the Purchase Order amount exceeds the max agreed Purchase Order Amount.	**Order-Preserving Encryption**
Maximum Purchase Amount	Confidential: Only contractor and supplier can access information.	Undelivered Units, Unit Price	Numerical comparison: Check whether the Purchase Order amount exceeds the max agreed Purchase Order Amount.	**Order-Preserving Encryption**
Due-time Shipping Delay	Confidential: Only contractor and supplier can access information.	Due-time Shipping Delay, Order Date, Negotiated shipping delay, Delivery Order status	Numerical comparison: Used to check for compliance with negotiated due-time shipping delay by comparing the actual shipping delay to the negotiated shipping delay in the public procurement contract.	**Order-Preserving Encryption**
Penalty coefficient	Confidential: Only contractor and supplier can access information.	Undelivered Units, Unit Price	Arithmetic operation: In case of penalties enforcement, penalties are linearly computed over penalty coefficient. For example, 10% of the undelivered units in addition to cost of the undelivered units is applied as a penalty.	**MPC**
Price of Goods	Confidential: Only contractor can access information.	Number of Goods, Unit Price	Arithmetic operation: Used to compute the overall price of the Purchase Order Amount.	**MPC**

Fig. 6

700



Protected Insights 262					
Extracted Insight 226	Privacy Enhancing Technique Insight List 258	Formula 247	Supplier Access to Extracted Insight 226	Contractor Access to Extracted Insight	Public Access to Extracted Insight
Contractor ID	None	No processing needed	65462	65462	65462
Supplier ID	None	No processing needed	58948	58948	58948
Contractor Phone Number	Symmetric Encryption	No processing needed	345-1645-6534	Confidential	Confidential
Contractor Delivery Address	Symmetric Encryption	No processing needed	564 K St Alexandria, Virginia 22314	Confidential	Confidential
Delivery Order Status	Garbled Circuit	Emergency OR Regular	Emergency OR Regular	Emergency OR Regular	Confidential
Due-Time Shipping Deky	Order-Preserving Encryption	If Emergency, then ((order date + due-time shipping delay) <= (order date + 48 hours)) = "On Time" If Regular, then ((order date + due-time shipping delay) <= (order date + 5 days)) = "On Time" Else: "Delayed"	On time OR Delayed	On time OR Delayed	Confidential
Purchase Order Amount	Order-Preserving Encryption	If PO amount < max amount: Then "Does not exceed"	Does not exceed	Does not exceed	Confidential
Maximum Purchase Order Amount	Order-Preserving Encryption	If PO amount < max amount: Then "Does not exceed"	Does not exceed	Does not exceed	Confidential
Penalty coefficient	MPC	Penalty coefficient = (0.1 * undelivered units * unit price) + (undelivered units *unit price)	$999	$999	Confidential
Price of Goods	MPC	Price = PO amount * unit price	Confidential	$9990	Confidential

Fig. 7

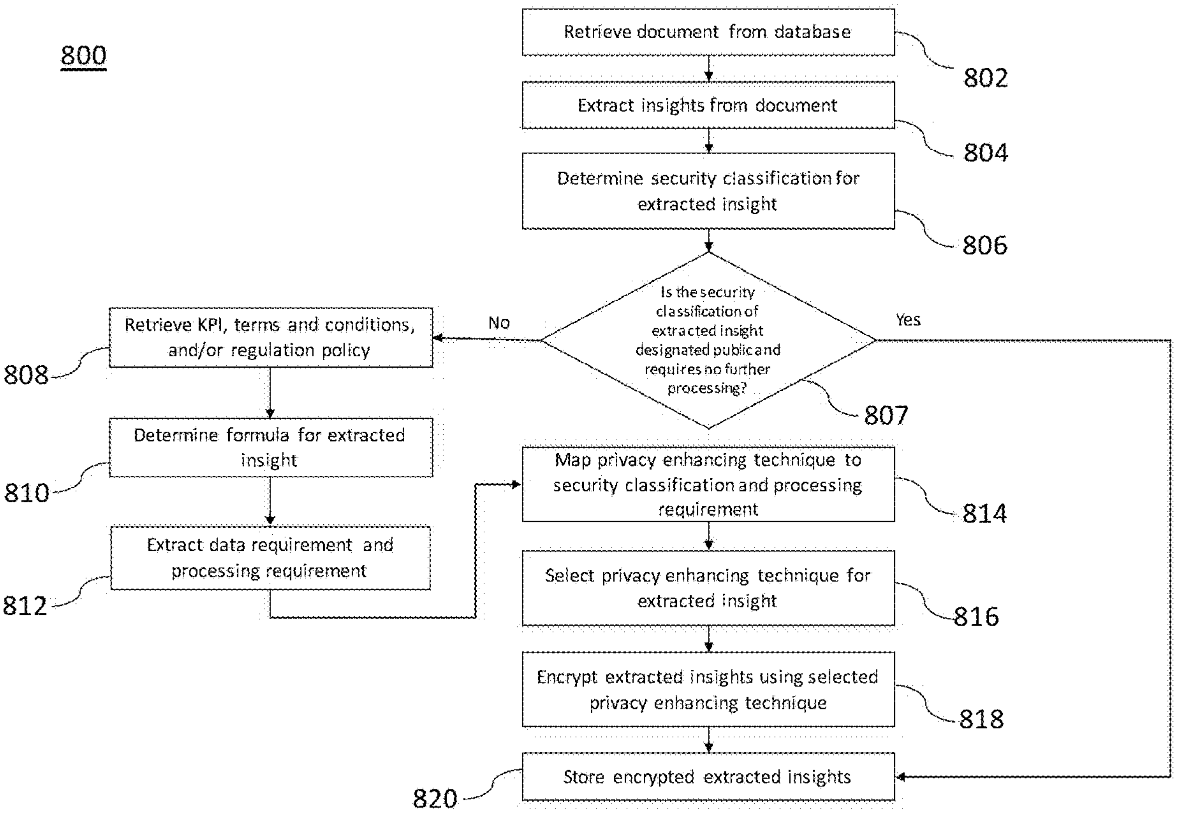

800
Retrieve document from database
802
Extract insights from document
804
Determine security classification for extracted insight
806
Is the security classification of extracted insight designated public and requires no further processing?
807
No
Yes
Retrieve KPI, terms and conditions, and/or regulation policy
808
Determine formula for extracted insight
810
Extract data requirement and processing requirement
812
Map privacy enhancing technique to security classification and processing requirement
814
Select privacy enhancing technique for extracted insight
816
Encrypt extracted insights using selected privacy enhancing technique
818
Store encrypted extracted insights
820

Fig. 8

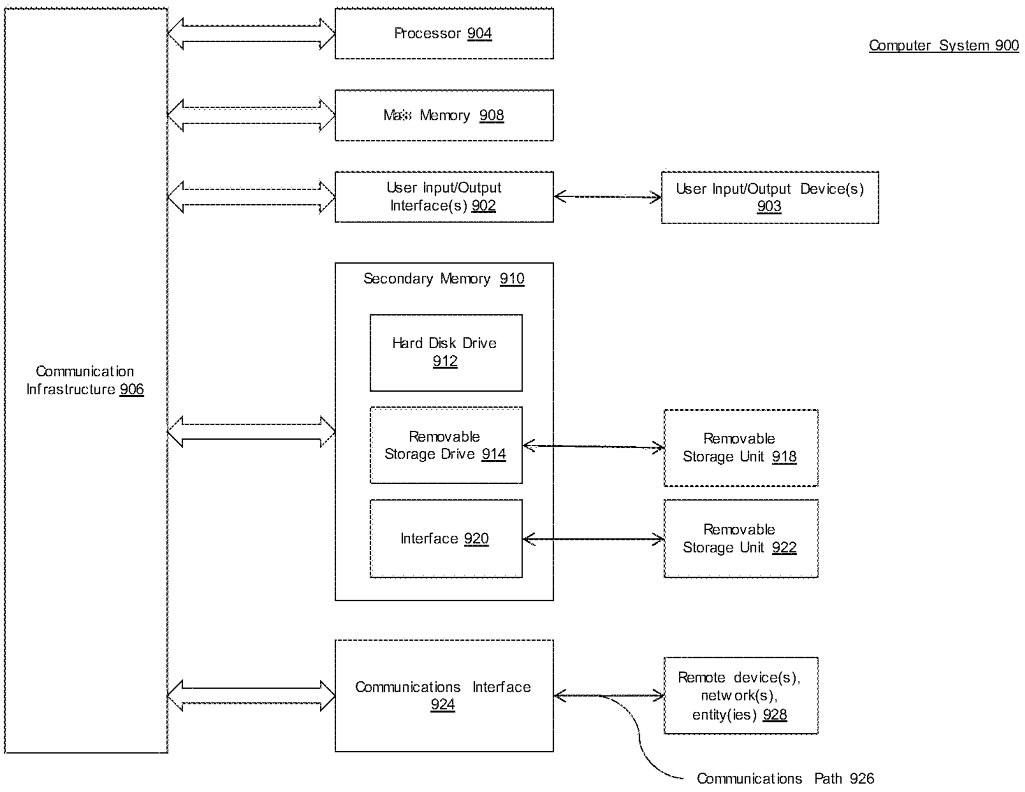

Processor 904
Computer System 900
Main Memory 908
User Input/Output Interface(s) 902
User Input/Output Device(s) 903
Secondary Memory 910
Hard Disk Drive 912
Communication Infrastructure 906
Removable Storage Drive 914
Removable Storage Unit 918
Interface 920
Removable Storage Unit 922
Communications Interface 924
Remote device(s), network(s), entity(ies) 928
Communications Path 926

FIG. 9

DATA PRIVACY ENHANCING TECHNIQUE SELECTION

BACKGROUND

Data privacy regulations place non-negotiable legal restrictions on the nature and extent of data collection and dissemination. Various data privacy enhancing techniques have surfaced in light of these data privacy regulations. However, compliance with data privacy regulations may create challenges in the usability of protected data. As a result, data privacy enhancing techniques suffer from limited and targeted post-processing capabilities. Therefore, the context in which each data privacy enhancing technique should be used is variable based on the intended usage of protected data.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are incorporated herein and form a part of the specification.

FIG. **1** is a block diagram illustrating a system architecture for data privacy enhancing technique selection, according to some embodiments.

FIG. **2** is a block diagram illustrating a system for data privacy enhancing technique selection, according to some embodiments.

FIG. **3** is an example illustrating a system for extracting insights from a document, according to some embodiments.

FIG. **4** is an example table illustrating a system for determining the security classification for extracted insights from a document, according to some embodiments.

FIG. **5**A is an example table illustrating an intended use classification model for determining the intended usage of extracted insights, according to some embodiments.

FIGS. **5**B and **5**C are example flow charts illustrating formula extraction and processing extraction for extracted insights, according to some embodiments.

FIG. **6** is an example table illustrating data privacy enhancing technique selection, according to some embodiments.

FIG. **7** is an example table illustrating a system for encrypting extracted insights using corresponding selected privacy enhancing techniques, according to some embodiments.

FIG. **8** is a flowchart illustrating a method for intended usage driven data privacy enhancing technique selection, according to some embodiments.

FIG. **9** is an example computer system useful for implementing various embodiments.

In the drawings, like reference numbers generally indicate identical or similar elements. Additionally, generally, the left-most digit(s) of a reference number identifies the drawing in which the reference number first appears.

DETAILED DESCRIPTION

Provided herein are system, apparatus, device, method and/or computer program product embodiments, and/or combinations and sub-combinations thereof, for data privacy enhancing technique selection. With the emergence of mass data collection and dissemination, many global data privacy regulations have surfaced to regulate and safeguard the transfer of data. For example, the European Union enacted the General Data Protection Regulation (GDPR) in 2018 to place regulations upon the manner in which organizations collect and disseminate data related to European Union residents and citizens. These regulations include how organizations may process data (e.g., collecting, recording, organizing, structuring, storing, using, deleting data). Furthermore, the GDPR specifies the nature of the data that organizations may collect and disseminate (e.g., personal data, names, email addresses, location information, biometric data, web cookies).

The GDPR regulates how organizations process data protected under the GDPR. For example, processing protected data must be legally compliant and transparent to the data subject and used for legitimate purposes explicitly specified to the data subject. Organizations can collect and process only as much data as necessary for the purposes specified and in a manner ensuring appropriate security and confidentiality. The organization is responsible for demonstrating GDPR compliance. Regulatory agencies may levy strict penalties and heavy fines for violation of the privacy and security standards set forth in the GDPR.

Similarly, California passed the California Consumer Privacy Act (CCPA) in 2018 to place regulations on the manner in which data certain U.S. companies collect and disseminate data in California. The CCPA aims to safeguard consumer data privacy for California residents in a manner similar to the GDPR. The CCPA sets forth guidelines allowing consumers in California to view CCPA-protected information that a company has collected and stored, along with the third parties who have received such information. Similar to the GDPR, the CCPA mandates hefty fines on qualifying organizations for non-compliance.

With the continuing emergence of data privacy regulations, various privacy preserving solutions (e.g., secure multi-party computation (MPC), data anonymization, differential privacy, order-preserving encryption, FHE) have been developed to ensure compliance with the regulations. While these privacy preserving solutions enable compliance with data privacy regulations, each technique may target the nature of protected data and its respective processing in a different and limited manner. For example, MPC allows entities to use protected data in a limited manner while the data is still encrypted. To ensure compliance with data privacy regulations, the goal of MPC is directed to the manner in which protected data is processed rather than how specific categories of protected data (e.g., integer, boolean, string) are encrypted. Similarly, the goal of order-preserving encryption scheme (OPES) is directed to comparing numerical operations to be directly applied on encrypted data without decrypting the operands.

On the other hand, the goal of data anonymization is directed to transforming the nature of data itself to ensure compliance with data privacy regulations. Data anonymization enables removal of personally identifiable information from data sets to ensure the data subjects may remain anonymous. Similarly, the goal of differential privacy is directed to withholding information describing certain individuals from whom data is collected. Differential privacy is a system for aggregating information about a dataset by describing patterns in a group while withholding information about individuals belonging to the dataset.

While these privacy enhancing techniques enable compliance with data privacy regulations, each privacy preserving technique may be useful in some contexts while compromising the usability of protected data in other contexts. Each privacy enhancing technique faces unique limited and targeted post-processing capabilities. Accordingly, data scientists face difficulty in selecting the right data privacy preserving tool that maximizes the usability of encrypted data based on the particular data processing needs or intended usage of protected data in diverse contexts. Therefore, a technical solution is needed to optimize compliance with data privacy regulations and the usability of protected data by automating selection of privacy enhancing techniques based on the intended usage and data privacy requirements for particular data in each unique context.

FIG. **1** is a block diagram illustrating a system architecture for data privacy enhancing technique selection, according to some embodiments. System **100** includes document database **110**, insight extractor **120**, privacy enhancing technique selector (PET selector) **130**, data security classifier **135**, intended use classifier **145**, insight encryptor **160**, and secure extracted insights database **170**.

Document database **110** may be a database that stores documents. System **100** may retrieve documents from document database **110** to perform insight extraction, privacy enhancing technique selection, and insight encryption. Insight extractor **120** may retrieve documents from document database **110**. Insight extractor **120** may use data preparation and data cleaning techniques known to a person of ordinary skill in the art to segment the document retrieved from document database **110** and place the document in condition for insight extraction. Insight extractor **120** may use data mining techniques to extract key insights that PET selector **130** may use to perform privacy enhancing technique selection.

PET selector **130** may identify the appropriate privacy enhancing technique corresponding to the retrieved extracted insights. Data security classifier **135** may retrieve extracted insights to determine a security classification for each of the extracted insights. By determining the security classification of an extracted insight, data security classifier **135** ensures the extracted insight meets data privacy requirements set forth in data privacy regulations based on a designated security classification. Data security classifier **135** may use machine learning techniques known to a person of ordinary skill in the art to determine a security classification for an extracted insight.

Intended use classifier **145** may determine the intended usage of an extracted insight, according to some embodiments. Intended use classifier **145** may determine a formula that corresponds to an extracted insight and extract processing requirements and data requirements for the corresponding formula, according to some embodiments. By determining the processing requirement of an extracted insight, intended use classifier **145** enables customized processing for an extracted insight depending on the context of its respective processing requirement, according to some embodiments. PET selector **130** may identify the privacy enhancing technique corresponding to the security classification determined by data security classifier **135** and the processing and data requirements determined by intended use classifier **145**.

Insight encryptor **160** may process and encrypt the privacy enhancing technique corresponding to an extracted insight selected by PET selector **130**. Insight encryptor **160** may store the encrypted extracted insights in a secure extracted insights database **170**. The privacy enhancing technique for the corresponding extracted insight may ensure the corresponding extracted insight complies with data privacy regulations and other confidentiality concerns based on its respective security classification while still enabling the processing of the protected data based on the unique processing requirement of the extracted insight. Accordingly, this privacy enhancing technique solution provides a technical solution to ensure compliance with data privacy regulations while increasing the usability of protected extracted insights.

Document database **110** and secure extracted insights database **170** may each be a data store. Document database **110** and secure extracted insights database **170** may each be a relational database, a NoSQL database or other horizontally scaling database, or any other database adhering to a suitable database design methodology, or any combination thereof. In an embodiment, the data store may implement a centralized storage area network (SAN), network-attached storage (NAS), redundant array of independent disks, and/or any other configuration of storage devices to supply sufficient storage capacity to store database tables and supporting structures. Sufficient storage may alternatively exist in any other physically attached magnetic storage, cloud storage, or additional storage medium. In an embodiment, the data store may deploy a hard-disk interface, such as ATA, SATA, SCSI, SAS, and/or fibre for interfacing with storage mediums.

FIG. **2** is a block diagram illustrating a system for data privacy enhancing technique selection, according to some embodiments. FIG. **2** is described with reference to FIG. **1**. Insight extractor **120** may retrieve document **210** from document database **110**. Insight extractor **120** may retrieve extracted insight **226** from document **210**. Insight extractor **120** may rely on data mining techniques known to a person of ordinary skill in the art to extract insights from document **210**. Insight extractor **120** may perform document segmentation **222** and insight extraction **224** to retrieve extracted insight **226**.

Document segmentation **222** includes data preparation and data cleaning techniques known to a person of ordinary skill in the art. Prior to retrieving any particular data from document **210**, insight extractor **120** may clean the data in document **210** by removing or correcting data in document **210** that would place document **210** in condition for further insight extraction **224**. Upon cleaning the data in document **210**, insight extractor **120** may perform document segmentation **222** by using data preparation techniques. These data preparation techniques can include document segmentation techniques such as sentence classifier model **223**. Insight extractor **120** may use sentence classifier model **223** to split document **210** into segments classifying various sentences. Each segment may have a relevant meaning or purpose to enable insight extractor **120** to complete insight extraction **224**. While insight extractor **120** may use sentence classifier model **223** to complete document segmentation **222**, insight extractor **120** may also split document **210** into segments categorized by words, sentences, topics, phrases, or other units of information depending on the nature of the extracted insight **226** to be retrieved.

By performing document segmentation **222**, insight extractor **120** may have placed document **210** in condition to process insight extraction model **220** in order to extract insights from document **210**. Insight extractor **120** may extract insights from document **210** using artificial intelligence techniques, including, but not limited to, K-nearest neighbors, regression, or natural language processing (NLP). Insight extractor **120** may use any data mining techniques for extracting insights from document **210** known to a person of ordinary skill in the art. Upon performing document segmentation **222** and applying insight extraction model **220**, insight extractor **120** may retrieve extracted insight **226** from document **210**. Insight extractor **120** may also store process related data **228** extracted during insight extraction **224** and document segmentation **222**, including data based on the terms and conditions of document **210**.

PET selector **130** may perform PET selection model **230** to select a privacy enhancing technique corresponding to extracted insight **226**. Extracted insight **226** may include one or more extracted insights, individual extracted insights, and/or may be grouped into a category of extracted insights. PET selection model **230** may include security classification model **235** and intended use classification model **245** to select the appropriate privacy enhancing technique for extracted insight **226**. Data security classifier **135** may perform security classification model **235** to determine the targeted level of data protection (e.g., public, private, confidential) for the extracted insight **226** retrieved from document **210**. Additionally, intended use classifier **145** may perform intended use classification model **245** to determine the required processing needs for extracted insight **226** (e.g., computing an average, comparison of numerical or Boolean values, etc.).

PET selector **130** may perform security classification model **235** to classify the security level for extracted insight **226**. Security classification model **235** may include data classification **236** and security classification **238**. PET selector **130** may perform data classification model **237** using artificial intelligence techniques known to a person of ordinary skill in the art to determine the data classification **236** corresponding to extracted insight **226**. For example, PET selector **130** may use data classification model **237** to classify extracted insight **226** as personal identifiable information (e.g., phone number, e-mail, name), contractual information, purchase order information, and/or public information.

PET selector **130** may use a rule-based security classification **238** to classify the level of security for extracted insight **226**. Security classification **238** may include the data classification **236** for a particular extracted insight **226** to determine security classification **238**. Data security classifier **135** may also use a security policy **239** to determine the security classification **238** of extracted insight **226**. Using the data classification **236** and/or security policy **239** of extracted insight **226**, PET selector **130** may determine the security classification **238** for extracted insight **226**.

Intended use classification model **245** may include formula extraction **246**, processing extraction **248**, and/or data extraction **252**. Intended use classifier **145** may use intended use classification model **245** to determine formula **247** based on pre-determined key performance indicators (KPI) **242**, terms and conditions **241**, and/or regulation policy **243**. KPI **242** may be a mathematical function or a formula describing a calculation, and various other metadata associated with KPI **242**. KPI **242** may represent an integer, decimal, floating point number, string, or other text. Metadata associated with KPI **242** may include contextual information and a formal language query (or queries) used to generate KPI **242**. According to an embodiment, KPI **242** may be data driven indicators statically drawn from data across a wide-array of data-driven applications. According to some embodiments, KPI **242** may be dynamically retrieved by machine learning techniques that extract mathematical expressions from textual sources such as document **210**.

Intended use classifier **145** may retrieve terms and conditions **241** to determine a formula **247** associated with extracted insight **226**. Intended use classifier **145** may use the process related data **228** associated with terms and conditions **241** to determine the formula **247** associated with extracted insight **226**. Intended use classifier **145** may associate the segments extracted from document segmentation **222** to identify the relevant terms and conditions associated with extracted insight **226**.

Intended use classifier **145** may retrieve regulation policy **243** to determine a formula **247** for extracted insight **226**. Intended use classifier **145** may analyze the requirements for compliance with regulation policy **243** in deriving formula **247**. In some embodiments, regulation policy **243** may be the same as security policy **239**. In some embodiments, regulation policy **243** may be based on the security classification **238** for extracted insight **226**.

Intended use classifier **145** may perform formula extraction **246** to extract a mathematical expression from terms and conditions **241**, KPI **242**, and/or regulation policy **243**. Formula **247** may be the mathematical expression that intended use classifier **145** extracted from terms and conditions **241**, KPI **242**, and/or regulation policy **243**. Based on the extracted formula **247**, intended use classifier **145** may perform processing extraction **248** to determine the processing requirement **250** for extracted insight **226**. Based on the extracted formula **247**, intended use classifier **145** may perform data extraction **252** to determine the data requirement **254** for extracted insight **226**. Processing extraction **248** and data extraction **252** may incorporate machine learning techniques, including natural language processing, to extract processing requirement **250** and data requirement **254**. Processing requirement **250** may be the performed operation represented by formula **247** (e.g., sum, average, mean, calculation). Data requirement **254** may be the function input parameters required to process formula **247**.

Upon determining security classification **238**, processing requirement **250**, and/or data requirement **254**, PET selector **130** may perform PET selection **256**. Based on the security classification **238** and processing requirement **250**, PET selector **130** may select the most appropriate privacy enhancing technique for extracted insight **226** (e.g., zero-knowledge proofs, multi-party computation, fully homomorphic encryption, order preserving encryption, trusted execution environments, differential privacy). PET selector **130** may associate extracted insight **226** with the appropriate privacy enhancing technique. PET selector **130** may generate a PET insight list **258** representing a list of each extracted insight **226** with its mapping to the relevant privacy enhancing technique.

Insight encryptor **160** may execute the selected privacy enhancing technique for extracted insight **226**. Once insight encryptor **160** processes and encrypts extracted insight **226**, the resulting value may be protected insight **262**. Protected insight **262** may also include an extracted insight **226** that did not have a security classification **238** and/or processing requirement **250**. Privacy preserving credentials may be generated to protect protected insight **262**. Insight encryptor **160** may use data requirement **254** to apply the function input parameters to the selected privacy enhancing technique for extracted insight **226**. Insight encryptor **160** may encrypt and store protected insight **262** in secure extracted insights database **170**.

FIG. **3** is an example illustrating a system for extracting insights from a document, according to some embodiments. FIG. **3** is described with reference to FIG. **1** and FIG. **2**. To describe the features and functions of system **100** and system **200**, reference is made to an example public procurement scenario. Public procurement is subject to data privacy regulations as set forth in the European Union directives for public procurement. This example illustrates employing the privacy enhancing technique selection using a public procurement contract.

The public procurement contract may require upfront data mining into the document to gain key insights (e.g., the terms and conditions of the purchase order, outbound delivery process, supplier and contractor information) set forth in the contract. To use insight extraction model **220**, insight extractor **120** may first receive document **310** from document database **110**. Document **310** may be a public procurement contract containing non-negotiable legal obligations, terms, and conditions. Upon retrieving document **310** from document database **110**, insight extractor **120** may perform document segmentation **222** techniques to extract key insights from document **310**. Insight extractor **120** may first perform data cleaning techniques to place document **310** in condition for insight extractor **120** to retrieve extracted insight **226**.

Upon completing data cleaning techniques with document **310**, insight extractor **120** may process data preparation techniques such as document segmentation. Document segmentation classifies the context of each sentence (e.g., which term and condition is defined in a sentence). Sentence classifier model **223** may be performed based on heuristics (e.g., the regular expression of a sentence or parts of speech) or based on sentence semantic similarities (e.g., K-Nearest Neighbors algorithm). Based on reference sentences, insight extractor **120** may evaluate the similarity of each sentence in document **310**.

In this case, insight extractor **120** may split the document into segments based on topics or sentences. For example, insight extractor **120** may split document **310** into segments representing the various topics or sections. In some embodiments, insight extractor **120** may split document **310** into segments for each sentence wherein each segment may be a sentence or clause representing different terms and conditions. Insight extractor **120** may generate a list of labels per sentence, such as, "2.1 Purchase Order Amount," "2.2 Price of Goods," "3.1 Emergency Delivery," "3.2 Maximum Delivery Time," and/or "3.3 Penalty." For example, the sentence "in case of emergency, the maximum delivery time is set at forty (48) hours from receipt of each purchase order," would be labeled as "Emergency Delivery." The "Emergency Delivery" label is determined based on the identification of the word "emergency" in the sentence and the word delivery is determined by its proximity to the word "emergency" within the reference sentence.

Using document segmentation **222**, insight extractor **120** has placed document **310** in condition for extracting insights. In the case of a public procurement scenario, suppliers and contractors generally consider certain recurring variables when negotiating the terms and conditions of the purchase order and the due-time outbound delivery process. For example, when negotiating the terms and conditions of the purchase order, parties may consider the purchase order amount, the price of goods, and/or the maximum purchase amount.

Once a purchase order is emitted by a recipient to a supplier, the supplier must fulfill certain contractual obligations regarding good delivery. If the supplier fails to comply with these legal obligations, the supplier may be subject to stiff penalties. There are certain variables common when negotiating outbound delivery. Relevant information to outbound delivery may include the delivery order status (e.g., emergency or regular delivery schedule), due-time shipping delay, and a penalty coefficient.

To ensure compliance with the European Union Public Procurement Guidelines, insight extractor **120** may need to extract insights such as a contractor ID and supplier ID. In order to fulfill the obligations of the public procurement contract, insight extractor **120** may extract other insights such as the contractor's phone number and the contractor's delivery address to ensure the supplier fulfills its good delivery obligations.

Once each segment of document **310** has been labeled, insight extractor **120** may use NLP-based extraction **225** to perform insight extraction **224**. Using the same clause as an illustration, insight encryptor **160** may extract the due-time delivery delay information, 48 hours, in the case of an emergency. This may be detected by processing a regular expression on the example sentence from document **310** and detecting the number "48" and checking that the number is followed by the word "hours," "days," or "months." In some embodiments, insight encryptor **160** can determine the due-time delivery delay by using parts of speech processing to detect a number followed by a noun.

Insight extractor **120** may use NLP-based extraction **225** to extract insights for the purchase order from the segments labeled "2.1 Purchase Order Amount" and "2.2 Price of Goods" including the purchase order amount, the price of goods, and/or the maximum purchase amount. Insight extractor **120** may then use NLP-based extraction **225** to extract insights for the due-time outbound delivery process from the segment of document **310** labelled "3.1 Emergency Delivery," "3.2 Maximum Delivery Time," and/or "3.3 Penalty." Finally, using NLP-based extraction **225**, insight extractor **120** may retrieve general contractor and supplier information, such as the contractor ID, supplier ID, and contractor phone number and delivery address, from the top of document **310**, in which supplier and contractor information may typically be located in a public procurement contract. Upon completion of document segmentation **222** and insight extraction **224**, insight extractor **120** may store extracted insight **226** in a database.

FIG. **4** is an example table illustrating a system for determining the security classification for extracted insights from a document, according to some embodiments. FIG. **4** is described with reference to FIG. **1**, FIG. **2**, and FIG. **3**. Upon retrieving extracted insight **226** from document **310**, data security classifier **135** may use security classification model **235** to determine the security classification **238** for extracted insight **226**. To determine security classification **238**, data security classifier **135** may first determine the data classification **236** for extracted insight **226**.

Using artificial intelligence techniques known to a person of ordinary skill in the art, data security classifier **135** may determine a data classification **236** for extracted insight **226**. Data security classifier **135** may then use data classification **236** and a security policy **239** to determine the security classification model **235** for extracted insight **226**. The security policy **239** may include the intentions of contractual parties, a data privacy regulation, a cybersecurity policy, or another security policy restricting the collection and dissemination of data.

Using artificial intelligence techniques, data security classifier **135** may determine that the contractor phone number and contractor delivery address are the contractor's personal identifiable information because information such as names, addresses, and contact information are oftentimes designated as personal identifiable information. Data privacy regulations oftentimes regulate the disclosure of personal identifiable information. Therefore, using the data classification **236**, data security classifier **135** may designate a confidential security classification **238** for the contractor ID and supplier ID. Accordingly, only the supplier may be able to access this information.

Using artificial intelligence techniques, data security classifier **135** may determine the extracted insight **226** for the purchase order amount, maximum purchase amount, and price of goods belong to a data classification **236** representing purchase order. Using the data classification **236** for extracted insight **226**, data security classifier **135** may determine that the security classification **238** for purchase order amount and maximum purchase amount should be designated as confidential and that only the contractor and supplier may access this information to fulfill their respective obligations for the purchase order. On the other hand, based on data classification **236** and other pre-determined rules, data security classifier **135** may determine only the contractor needs to access the extracted insight **226** representing the price of goods to ensure the contractor fulfills its payment obligations to the supplier in accordance with the purchase order as represented by data classification **236**.

Using artificial intelligence techniques, data security classifier **135** may determine the extracted insight **226** for delivery order status, due-time shipping delay, and the penalty coefficient belong to a data classification **236** representing contractual information. Using the data classification **236** for extracted insight **226**, data security classifier **135** may determine that the security classification **238** for delivery order status, due-time shipping delay, and the penalty coefficient should be designated as confidential and that only the contractor and supplier may access this information to fulfill their respective contractual obligations for outbound delivery outlined in document **310**.

FIG. **5**A is an example table illustrating an intended use classification model, according to some embodiments. FIG. **5**A is described with reference to FIG. **1**, FIG. **2**, FIG. **3**, and FIG. **4**. Intended use classifier **145** may use the intended use classification model **245** to determine intended usage of extracted insight **226**. To determine the intended usage of extracted insight, intended use classifier **145** may use formula extraction **246** to determine a formula **247** that best represents the intended usage of extracted insight **226**. To derive formula **247**, intended use classifier **145** may consider the terms and conditions **241** of document **310**, KPI **242**, and/or regulation policy **243**.

Upon selecting a formula **247**, intended use classifier **145** may use processing extraction **248** to determine the processing requirement **250** and data extraction to determine the data requirement **254** for extracted insight **226**. Processing requirement **250** may be the performed operation represented by formula **247** (e.g., sum, average, mean, calculation). Data requirement **254** may be the function input parameters required to process formula **247**.

Accordingly, in the public procurement context, suppliers and public contractors may consider terms and conditions as strictly confidential. Nevertheless, without sharing the details of individual transactions, contractually involved parties may still want to enable third parties (e.g. general public, market analysts, call for tender candidates) to compute KPIs including percentage of late delivery, penalty computation for late delivery, price of goods computation, etc. Moreover, suppliers and public contractors may generally consider data privacy considerations in the context of the European Public Procurement Guidelines. Finally, suppliers and public contractors may need to consider the terms and conditions **241** of a document **210** to determine a formula **247** that best represents the intended use of extracted insight **226** from a document **210**.

When performing formula extraction **246**, intended use classifier **145** may use KPI **242** related to purchase orders and/or due-time delivery, regulation policy **243** based on the European Union Public Procurement Guidelines, and/or the terms and conditions **241** from document **310** to generate a formula **247** representing a mathematical expression for extracted insight **226**.

For certain types of information, such as personally identifiable information or public information, there may be no applicable KPI **242**, regulation policy **243**, and/or terms and conditions **241** relevant for intended use classifier **145** to process for formula extraction **246**, according to some embodiments. Accordingly, intended use classifier **145** may determine formula extraction **246** is not applicable to the extracted insight **226** associated with contractor ID and supplier ID because these insights have a public security classification **238**. Similarly, because there is no processing involved with the contractor's personal identifiable information (e.g., the contractor phone number and contract delivery address), intended use classifier **145** may determine there is no applicable formula **247** for the extracted insight **226** associated with the contractor's personal identifiable information.

On the other hand, suppliers and contractors may generally have applicable KPI **242**, terms and conditions **241**, and/or regulation policy **243** relevant to the extracted insight **226** associated with the data classification **236** for purchase order and contractual information. Intended use classifier **145** may use the process related data **228** extracted during insight extraction **224** to determine the relevant terms and conditions **241** to process for formula extraction **246**.

Referring to FIG. **5**B, intended use classifier **145** may use machine learning techniques to determine the data requirement **254** and processing requirement **250** extracted from formula **247** for the extracted insight **226** associated with due-time delivery. Intended use classifier **145** may first use the process related data **228** associated with terms and conditions **241** to determine the formula **247** for delivery order status, due-time shipping delay, and penalty coefficient. For the delivery order status, intended use classifier **145** may use the sentence segment associated with section "3.1 Emergency Delivery" from document **310** to extract formula **247** for the delivery order status extracted insight **226**. Intended use classifier **145** may then use a delivery order status computation KPI **242** associated with emergency delivery data generally extracted from public procurement contracts. Using the delivery order status KPI **242** and terms and conditions **241** sentence segment for section "3.1 Emergency Delivery," intended use classifier **145** may use formula extraction **246** to determine the formula **247** for the delivery order status extracted insight **226** would be as follows:

Formula 247 (Purchase Order Status)=emergency OR regular

Intended use classifier **145** may then use processing extraction **248** to extract the process requirement **250** and data extraction **252** to extract the data requirement **254** for the formula **247** associated with the purchase order status extracted insight **226**. Using machine learning techniques, intended use classifier **145** may determine the processing requirement **250** for the formula **247** associated with the purchase order status extracted insight **226** would involve a Boolean comparison. Particularly, intended use classifier **145** may determine the Boolean comparison would require a comparison of whether the delivery order status is emergency or regular and that the due-time delivery depends on whether this constraint is met. Additionally, intended use classifier **145** may determine the data requirement **254** used to process the formula **247** associated with the purchase order status would require a boolean input of the delivery order status (e.g., emergency or regular status). As shown in FIG. **5**B, the first consideration in a due-time delivery negotiation is whether the purchase order has an emergency status or regular status, which requires a Boolean comparison.

If the delivery order status is an emergency status, then the next consideration in ensuring good delivery is whether the due-time delivery has exceeded the due-time delivery in the case of an emergency as set forth in document **310**. Otherwise, the next consideration is whether the due-time delivery has exceeded the due-time delivery under regular conditions as set forth in document **310**.

The intended use classifier **145** may then determine the formula **247** for the due-time shipping delay extracted insight **226**. Intended use classifier **145** may determine the KPI **242** associated with due-time shipping delay is the percentage of late delivery. In some embodiments, intended use classifier **145** may use the percentage of late delivery KPI **242** to check for compliance with negotiated due-time shipping delays based on the average of previous shipping delays. In some embodiments, intended use classifier **145** may determine the formula **247** for the due-time shipping delay based on the terms and conditions **241** set forth in document **310**. As shown in FIG. **5**B, once the intended use classifier **145** ascertains the delivery order status for the purchase order, the intended use classifier **145** may then determine the formula **247** for the due-time shipping delay based on the delivery order status. Accordingly, intended use classifier **145** may use formula extraction **246** to extract the following formula **247** for the due-time shipping delay extracted insight **226**:

Formula 247 (Due-Time Shipping Delay)=if Delivery Order Status="Emergency", then Order Date+Due-Time Shipping Delay<=Order Date+48 Hours="On Time"

if Delivery Order Status="Regular", then Order Date+Due-Time Shipping delay<=Order Date+5 Days="On Time"Else: "Delayed"

Intended use classifier **145** may then use processing extraction **248** to extract the processing requirement **250** and data extraction **252** to extract the data requirement **254** for the formula **247** associated with the due-time delivery delay extracted insight **226**. Using machine learning techniques, intended use classifier **145** may determine the processing requirement **250** for the formula **247** associated with the purchase order status extracted insight **226** would involve a numerical comparison. Particularly, intended use classifier **145** may determine the numerical comparison would be used to check for compliance with the negotiated due-time shipping delay by comparing the numerical value of the negotiated timeframe set forth in document **310** to the actual due-time shipping delay. Additionally, intended use classifier **145** may determine the data requirement **254** used to process the formula **247** associated with the due-time shipping delay would require mathematical inputs of the delivery order status for determining which due-time shipping delay to consider from document **310**, the order date for determining the date from which the shipping delay may be calculated, and the negotiated due-time shipping delay and actual due-time shipping delay for comparing whether the supplier has ensured good delivery.

As shown in FIG. **5**B, upon determining whether the deliver order is an emergency or regular status, the next consideration is whether the supplier has exceeded the maximum amount of time to deliver goods from the due-time shipping delay set forth in document **310** depending on if it is an emergency order (48 hours due-time shipping delay from the order date) or regular status (5 hours due-time shipping delay from the order date). Depending on whether the supplier has exceeded the due-time shipping delay set forth in document **310**, the intended use classifier **145** may apply penalties using a penalty coefficient.

Intended use classifier **145** may use a penalty computation KPI **242** and the sentence segment from section "3.3 Penalty" retrieved from process related data **228** during insight extraction **224** to determine the formula **247** associated with the penalty coefficient extracted insight **226**. As shown in section "3.3 Penalty" of document **310**, the penalty coefficient if the supplier fails to deliver the goods on time is the price of the undelivered units in addition to 10% of the price of the undelivered units. Accordingly, intended use classifier **145** may determine the formula **247** associated with the penalty coefficient extracted insight **226** is as follows:

Formula 247 (Penalty Coefficient)=(0.1*undelivered units*unit price)+(undelivered units*unit price)

Intended use classifier **145** may then use processing extraction **248** to extract the processing requirement **250** and data extraction **252** to extract the data requirement **254** for the formula **247** associated with the penalty coefficient extracted insight **226**. Intended use classifier **145** may determine the processing requirement **250** for the formula **247** associated with the penalty coefficient extracted insight **226** would involve arithmetic operation. Particularly, intended use classifier **145** may determine the arithmetic operation for the penalty coefficient requires computing the price of undelivered goods and adding 10% of the price of the undelivered goods. This requires multiplication and addition arithmetic operators to determine the penalty coefficient. Additionally, intended use classifier **145** may determine the data requirement **254** used to process the formula **247** associated with the due-time shipping delay would require numerical mathematical inputs of the undelivered units and the unit price.

Referring to FIG. **5**C, intended use classifier **145** may use machine learning techniques to determine the data requirement **254** and processing requirement **250** extracted from formula **247** for the extracted insight **226** associated with a purchase order. Intended use classifier **145** may first use the process related data **228** associated with terms and conditions **241** to determine the formula **247** for the extracted insight **226** for the purchase order amount and maximum purchase order amount. Intended use classifier **145** may use the sentence segment associated with section "2.1 Purchase Order Amount" from document **310** to extract formula **247** for the purchase order amount and maximum purchase order amount extracted insight **226**.

Intended use classifier **145** may then use a check matching quantity KPI **242** associated with purchase order amounts generally extracted from public procurement contracts. The check matching quantity KPI **242** may validate if the purchase order amount matches the maximum and minimum quantity as agreed to contractually. This KPI **242** may evaluate this comparison by checking whether the purchase order amount is in a certain range for the minimum purchase order amount and maximum purchase order amount.

Using the check matching quantity KPI **242** and terms and conditions **241** sentence segment for section "2.1 Purchase Order Amount," intended use classifier **145** may use formula extraction **246** to determine the formula **247** for the purchase order amount and maximum purchase order amount extracted insight **226** would be as follows:

Formula 247 (Purchase Order Amount or Maximum Purchase Order Amount)=^{f} (Purchase Order Amount<Maximum Purchase Order Amount) then "does not exceed"

Intended use classifier **145** may then use processing extraction **248** to extract the processing requirement **250** and data extraction **252** to extract the data requirement **254** for the formula **247** associated with the purchase amount and maximum purchase amount extracted insight **226**. Intended use classifier **145** may determine the processing requirement **250** for the formula **247** associated with the purchase order status extracted insight **226** would involve a numerical comparison. Particularly, intended use classifier **145** may determine the numerical comparison would be used to check whether the purchase order amount exceeds the negotiated maximum purchase order amount. Additionally, intended use classifier **145** may determine the data requirement **254** used to process the formula **247** would require mathematical inputs of the purchase order amount and maximum purchase order amount set forth in document **310**.

As shown in FIG. **5**C, upon confirming that the purchase order amount does not exceed the maximum purchase order amount set forth in document **310**, the next consideration would be the calculation of the price of goods. Otherwise, the system **100** may recalculate the purchase order amount or reduce the purchase order amount to an amount below the maximum purchase order amount.

Intended use classifier **145** may use a price of goods KPI **242** and the sentence segment from section "2.2 Price of Goods" retrieved from process related data **228** during insight extraction **224** to determine the formula **247** associated with the price of goods extracted insight **226**. As shown in section "2.2 Price of Goods" of document **310**, the price of goods may be determined by multiplying the purchase order amount and the unit price. Accordingly, intended use classifier **145** may determine the formula **247** associated with the price of goods extracted insight **226** is as follows:

Formula 247 (Price of Goods)=Purchase Order Amount*Unit Price

Intended use classifier **145** may then use processing extraction **248** to extract the processing requirement **250** and data extraction **252** to extract the data requirement **254** for the formula **247** associated with the price of goods extracted insight **226**. Intended use classifier **145** may determine the processing requirement **250** for the formula **247** associated with the price of goods extracted insight **226** would involve arithmetic operation. Particularly, intended use classifier **145** may determine the arithmetic operation for the price of goods requires computing the overall purchase order amount. This requires multiplication operators to determine the price of goods. Additionally, intended use classifier **145** may determine the data requirement **254** used to process the formula **247** associated with the price of goods would require the purchase order amount and the unit price.

FIG. **6** is an example table illustrating a system for determining the intended use classification for extracted insights from a document, according to some embodiments. FIG. **6** is described with reference to FIG. **1**, FIG. **2**, FIG. **3**, FIG. **4**, and FIG. **5**A. Various privacy enhancing solutions (e.g., secure multi-party computation, symmetric encryption, garbled circuit, order-preserving encryption) have been developed to ensure compliance with data privacy and security policies and regulations. While these privacy enhancing solutions enable compliance with data privacy regulations, the techniques may each target the nature of protected data and its respective processing in a different and limited manner. Each privacy enhancing technique may be useful in some contexts while compromising the usability of protected data in other contexts. PET selector **130** may optimize compliance with data privacy regulations and the usability of protected data by automating selection of privacy enhancing techniques based on the intended usage of extracted insight **226**. Using security classification **238**, processing requirement **250**, and data requirement **254** for extracted insight **226** from document **310**, the PET selector **130** may then map these combined factors to the most appropriate privacy enhancing technique.

PET selector may use PET selection **256** to generate a PET insight list **258** mapping a selected privacy enhancing technique to extracted insight **226**. The PET insight list **258** may also include the respective security classification **238**, processing requirement **250**, and/or data requirement **254** to the selected privacy enhancing technique for extracted insight **226**. As shown in the PET insight list **258**, when certain extracted insight **226** (e.g., contractor ID and supplier ID) is designated with a public security classification **238** and corresponds to no processing requirement **250**, PET selector **130** may not map the extracted insight **226** to a privacy enhancing technique, according to some embodiments. This may be due to the public nature of the public procurement context in which encryption may not be needed where the extracted insight **226** is publicly disclosed.

On the other hand, the European Union Public Procurement Guidelines may defer to the GDPR in protecting certain personal identifiable information. Accordingly, the contractor phone number and delivery address were given a confidential security classification **238**. In this case, PET selector **130** may map an extracted insight **226** with no processing requirement **250** and a confidential security classification **238** to the symmetric encryption privacy enhancing technique. Symmetric encryption uses the same key to encrypt and decrypt data and thereby both the supplier and contractor may possess the same secret key. Symmetric encryption may be beneficial where the security classification **238** is confidential because possessing one key for encryption and decryption may simplify the encryption process while providing data privacy and confidentiality without the complexity of multiple keys. Accordingly, this would allow the supplier to contact the contractor and deliver the supplies to the proper address without disclosing the contractor's personal identifiable information in violation of the GDPR and EU Public Procurement Guidelines.

In some embodiments, PET selector **130** may map an extracted insight **226** with a confidential security classification **238** with the numerical comparison processing requirement **250** to the order-preserving encryption privacy enhancing technique. Order-preserving encryption is a function that may preserve the numerical ordering of certain function inputs. PET selector **130** may determine the order-preserving encryption is most appropriate for usage with numerical comparison because it allows encrypted data to be directly applied to the comparison of operations without the need for decrypting the data, which may promote the efficiency of the numerical comparison while ensuring security and compliance with data privacy regulations. However, order-preserving encryption may not be useful for a different processing requirement **250** because it may not preserve the numerical ordering of certain function inputs because it may change the value of the inputs. In this case, order-preserving encryption allows for numerical comparisons for the purchase order amount, maximum purchase order amount, and due-time shipping delay extracted insight **226** without decrypting extracted insight **226**.

In some embodiments, PET selector **130** may map an extracted insight **226** with a confidential security classification **238** with the arithmetic computation processing requirement **250** to the MPC encryption technique. MPC allows parties to jointly compute the value of a public function with its encapsulated private data while a party may maintain the confidentiality of its own function inputs. PET selector **130** may determine MPC is most appropriate for usage with arithmetic computation because the method partially conceals confidential data while computing a correct output with the confidential data from various sources. This may be compatible with an arithmetic operation because MPC calculates the output of the arithmetic operation from the function inputs. However, MPC may be less applicable with other processing requirements depending on the intended use context because other processing requirements may not require a customizable function for computing desired output values in accordance with particular function inputs. In this case, MPC enables the computation of the price of goods based on the purchase order amount and unit price and the computation of the penalty coefficient based on the number of undelivered goods and unit price. MPC may enable the computation of the price of goods and penalty coefficient extracted insight **226** while still maintaining the confidentiality of the function inputs.

Finally, in some embodiments, PET selector **130** may map an extracted insight **226** with a confidential security classification **238** and Boolean comparison processing requirement **250** to the garbled circuit encryption technique. Garbled circuit enables two-party secure computation in which two mistrusting parties can jointly evaluate a function over their respective private inputs without the presence of a trusted third party. Within the garbled circuit protocol, the function is described as a Boolean circuit which necessitates the use of Boolean comparison. Through the confidential transfer, both parties may obtain an output without seeing the other party's confidential input. PET selector **130** may determine that the garbled circuit is inapplicable to a different processing requirement **250** such as the arithmetic operation because the technique requires a Boolean operator. In this case, garbled circuit may enable system **100** to check the binary value of the delivery order status to determine whether the due-time shipping delay has exceeded the negotiated shipping delay and whether penalties should be applied.

The mapping exemplified in this FIG. **6** is used for illustration purposes only, and depending on the intended usage of extracted insight **226** in a document **210**, PET selector **130** may map the extracted insight to the most appropriate privacy enhancing technique.

FIG. **7** is an example table illustrating a system for encrypting extracted insights using corresponding selected privacy enhancing techniques, according to some embodiments. FIG. **7** is described with reference to FIG. **1**, FIG. **2**, FIG. **3**, FIG. **4**, FIG. **5**A, and FIG. **6**. Insight encryptor **160** may execute the selected privacy enhancing techniques corresponding to extracted insight **226**. The privacy enhancing technique for the extracted insight may ensure the extracted insight complies with data privacy regulations and other confidentiality concerns based on its respective security classification while still enabling the processing of the data based on the unique processing requirements of the extracted insight.

Insight encryptor **160** may use data requirement **254** to apply the function input parameters to the selected privacy enhancing technique for extracted insight **226**. Insight encryptor **160** may then process and encrypt extracted insight **226** based on its respective selected privacy enhancing technique. The results from processing the privacy enhancing technique corresponding to extracted insight **226** may be protected insight **262**. Protected insight **262** may be the encrypted value of extracted insight **226**. Protected insight **262** may be the resulting values from processing formula **254** based on the data requirement **254** for extracted insight **226**. Protected insight **262** may include the value of extracted insight **226** in which insight encryptor **160** did not execute a corresponding privacy enhancing technique. Insight encryptor **160** may then store protected insight **262** in the secure extracted insights database **170**. Privacy preserving credentials may be generated to protect protected insight **262**.

An extracted insight **226** with a security classification **238** designated as public and requiring no processing requirement may not require processing or encryption. As shown in FIG. **7**, insight encryptor **160** may not apply a privacy enhancing technique for the contractor ID and supplier ID extracted insight **226** because its security classification **238** is designated as public and requires no further processing. Accordingly, the supplier, contractor, and public can gain access to the contractor ID and supplier ID from the secure extracted insights database **170** and would be able to see that the contractor ID is 65462 and the supplier ID is 58948.

On the other hand, EU Public Procurement Guidelines encourages compliance with the GDPR. Therefore, any personal identifiable information should be encrypted and only disclosed as necessary. Accordingly, because the security classification **238** for the extracted insight **226** for the contractor's personal identifiable information including the contractor phone number and contractor delivery address are confidential, only the supplier may access this information to ensure good delivery to the contractor. Accordingly, the supplier would be able to access the contractor's phone number, 345-164-6534, and the contractor's delivery address 564 K. St. Alexandria, Virginia 22314. The public would not be able to access this information. However, because this information did not require any additional processing, the phone number and delivery address are still the same values as shown in document **310**.

For each remaining extracted insight **226**, the security classification **238** is designated as confidential. Accordingly, the corresponding protected insight **262** is restricted to only the contractor and/or supplier. For the purchase order information, only the supplier and/or contractor may access extracted insight **226** associated with the purchase order data classification **236**. The purchase order amount and maximum purchase amount both require a numerical comparison to determine whether the purchase order amount exceeds the maximum purchase amount. Therefore, the data requirement **254** required for the purchase order amount and maximum purchase order amount would be the purchase order amount from document **310**, 999 units, and the maximum purchase order amount set forth in document **310**, 1999 units. Insight encryptor **160** may use order-preserving encryption to process the numerical comparison of these values while restricting the confidentiality of these values to the contractor and supplier. Accordingly, the supplier and contractor can access this information and confirm that the purchase order amount, 999 units, does not exceed the maximum purchase order amount, 1999 units, while protecting this data from access to the public.

Upon confirming the purchase order amount does not exceed the maximum purchase amount, insight encryptor **160** may apply the MPC privacy enhancing technique to calculate the price of goods. Insight encryptor **160** may apply MPC to calculate the price of goods by multiplying the purchase order amount, 999 units, with the unit price, $10, to determine the price of goods output would result in $9990. Only the contractor can access this information to determine its payment obligations to the suppliers without disclosing this information to the public. Therefore, the contractor can obtain the price of the goods while the supplier can maintain confidentiality of the purchase order amount and/or unit price.

For each extracted insight **226** with the contractual information data classification **236**, only the contractor and supplier may access protected insight **262**. Insight encryptor **160** may process garbled circuit to determine the delivery order status by completing a Boolean comparison of the emergency delivery order status and regular delivery order status. Only the supplier and contractor can gain access to the delivery order status.

Depending on the delivery order status extracted insight **226**, insight encryptor **160** perform order-preserving encryption for the due-time shipping delay extracted insight **226** by comparing the number of days or hours that have passed from the order date to the due-time shipping delay set forth in document **310** to determine if any penalties may be applied. Only the supplier and contractor can determine whether the supplier has exceeded the due-time shipping delay in delivering the supplies to the contractor.

Depending on whether the supplier has exceeded the due-time shipping delay in delivering the supplies to the contractor, the supplier and contractor may gain access to the penalty coefficient protected insight **262** from secure extracted insights database **270**. Insight encryptor **160** may process MPC to determine the penalty coefficient extracted insight **226**. Insight encryptor **160** may calculate the penalty coefficient based on the number of undelivered units and the unit price in addition to 10% of the number of undelivered units and the unit price. Only the supplier and contractor may retrieve the penalty coefficient without gaining access to the number of undelivered units and the unit price, while the public can gain information to neither the penalty coefficient, number of undelivered units, nor the unit price.

By selecting a privacy enhancing technique most appropriate for the security classification and processing requirement of extracted insight **226**, compliance with data privacy regulations and data security is strengthened while increasing the usability of protected data.

FIG. **8** is a flowchart illustrating a method for intended usage driven privacy enhancing technique selection, according to some embodiments. FIG. **8** is described with reference to FIGS. **1-7**. Method **800** can be performed by processing logic that can comprise hardware (e.g., circuitry, dedicated logic, programmable logic, microcode, etc.), software (e.g., instructions executing on a processing device), or a combination thereof. It is to be appreciated that not all steps may be needed to perform the disclosure provided herein. Further, some of the steps may be performed simultaneously, or in a different order than shown in FIG. **8**, as will be understood by a person of ordinary skill in the art.

At **802**, insight extractor **120** may retrieve document **210** from document database **110**. Document database **110** may be a database that stores documents including document **210**. System **100** may retrieve document **210** from document database **110** to perform insight extraction **224**, PET selection model **230**, and insight encryption. Insight extractor **120** may retrieve documents from document database **110**.

At **804**, insight extractor **120** may use insight extraction model **220** to extract extracted insight **226** from document **210**. Insight extractor **120** may perform document segmentation **222** and insight extraction **224** to retrieve extracted insight **226**. Document segmentation **222** includes data preparation and data cleaning techniques known to a person of ordinary skill in the art. Prior to retrieving any particular data from document **210**, insight extractor **120** may cleanse the data in document **210** by removing or correcting data in document **210** that would place document **210** in condition for further insight extraction **224**. Upon cleansing the data in document **210**, insight extractor **120** may perform document segmentation **222** by using data preparation techniques. These data preparation techniques can include document segmentation techniques such as sentence classifier model **223**. Insight extractor **120** may use sentence classifier model **223** to split document **210** into segments classifying various sentences. Each segment may have a relevant meaning or purpose to enable insight extractor **120** to complete insight extraction **224**. While insight extractor **120** may use sentence classifier model **223** to complete document segmentation **222**, insight extractor **120** may also split document **210** into segments categorized by words, sentences, topics, phrases, or other units of information depending on the nature of the extracted insight **226** to be retrieved.

By performing document segmentation **222**, insight extractor **120** may have placed document **210** in condition to process insight extraction model **224** in order to extract insights from document **210**. Insight extractor **120** may extract insights from document **210** using artificial intelligence techniques, including, but not limited to, K-nearest neighbors, regression, or natural language processing. Insight extractor **120** may use any data mining techniques for extracting insights from document **210** known to a person of ordinary skill in the art. Upon performing document segmentation **222** and applying insight extraction **224**, insight extractor **120** may retrieve extracted insight **226** from document **210**.

At **806**, data security classifier **135** may perform security classification model **235** to classify the security level for extracted insight **226**. Security classification **238** may include data classification **236** and security policy **239**. Data security classifier **135** may perform data classification model **237** using artificial intelligence techniques known to a person of ordinary skill in the art to determine the data classification **236** for extracted insight **226**.

Data security classifier **135** may use a rule-based security classification model **235** to classify the level of security for extracted insight **226**. Security Selection Model **235** may include the data classification **236** for a particular extracted insight **226** to determine security classification **238**. Security classification model **235** may also be based on a security policy **239** for determining the security classification **238** of extracted insight **226**. Using the data classification **236** and/or security policy **239** of extracted insight **226**, data security classifier **135** may determine the security classification **238** for extracted insight **226**.

At **807**, intended use classifier **145** may determine whether the security classification **238** for extracted insight **226** is designated public and requires no further processing. According to some embodiments, if intended use classifier **145** determines the security classification **238** for certain extracted insight **226** is designated as public and requires no further processing, system **100** proceeds to **820**. According to some embodiments, if intended use classifier **145** determines the security classification **238** for certain extracted insight **226** is not designated as public or requires further processing, system **100** proceeds to **808**.

At **808**, intended use classifier **145** may retrieve terms and conditions **241**, KPI **242**, and/or regulation policy **243** to determine a formula **247**. Intended use classifier **145** may determine the formula **247** based on pre-determined KPI **242**. KPI **242** may be a mathematical function or a formula describing a calculation, and various other metadata associated with KPI **242**. KPI **242** may represent an integer, decimal, floating point number, string, or other text. Metadata associated with KPI **242** may include contextual information and a formal language query (or queries) used to generate KPI **242**. According to an embodiment, KPI **242** may be data driven indicators statically drawn from data across a wide-array of data-driven applications. According to some embodiments, KPI **242** may be dynamically retrieved using machine learning techniques to extract mathematical expressions from textual sources such as document **210**.

Intended use classifier **145** may retrieve terms and conditions **241** to determine a formula **247** associated with extracted insight **226**. Intended use classifier **145** may use the process related data **228** associated with terms and conditions **241** to determine the formula **247** associated with extracted insight **226**. Intended use classifier **145** may associate the segments extracted from document segmentation **222** to identify the relevant terms and conditions associated with extracted insight **226**.

Intended use classifier **145** may retrieve regulation policy **243** to determine a formula **247** for extracted insight **226**. Intended use classifier **145** may analyze the requirements to comply with regulation policy **243** in deriving formula **247**. In some embodiments, regulation policy **243** may be the same as security policy **239**. In some embodiments, regulation policy **243** may be informed by security classification **238** for extracted insight **226**.

At **810**, intended use classifier **145** may determine a formula **247** associated with extracted insight **226**. Intended use classifier **145** may perform formula extraction **246** to extract a mathematical expression from KPI **242**. Formula **247** may be the mathematical expression intended use classifier **145** extracted from KPI **242**. Intended use classifier **145** may determine formula **247** for extracted insight **226** based on the retrieved terms and conditions **241** of document **210**, KPI **242**, and/or any applicable regulation policy **243**.

At **812**, intended use classifier **145** may perform processing extraction **248** to determine the processing requirement **250** and data extraction **252** to determine data requirement **254** for extracted insight **226**. Intended use classifier **145** may use formula **247** to determine processing requirement **250** and data requirement **254** for extracted insight **226**. Processing extraction **248** and data extraction **252** may incorporate machine learning techniques including natural language processing to extract processing requirement **250** and data requirement **254**. Processing requirement **250** may be the performed operation represented by formula **247** (e.g., sum, average, mean, calculation). Data requirement **254** may be the function input parameters required to process formula **247**.

At **814**, PET selector **130** may map security classification **238** and processing requirement **250** to a relevant privacy enhancing technique for extracted insight **226**. Depending on the processing requirement (e.g., numerical comparison, arithmetic operation, Boolean comparison) and the security classification **238** of extracted insight **226** (e.g., public, private, confidential, protected), PET selector **130** may map the appropriate privacy enhancing technique to extracted insight **226** that ensures compliance with the appropriate data privacy regulation while contextualizing the privacy enhancing technique to the processing requirement to increase the usability of protected data and reduce the limited post-processing capability of legacy privacy enhancing systems.

At **816**, PET selector **130** may select the appropriate privacy enhancing technique for extracted insight **226**. After PET selector **130** maps extracted insight **226** to an appropriate privacy enhancing technique, PET selector **130** may select the mapped privacy enhancing technique and may generate a PET insight list **258** representing a list of each extracted insight **226** with its mapping to the relevant privacy enhancing technique.

At **818**, insight encryptor **160** may process and encrypt the selected privacy enhancing techniques for extracted insight **226**. Once insight encryptor **160** executes the selected privacy enhancing technique corresponding to extracted insight **226**, the results may be protected insight **262**. Protected insight **262** may be the encrypted value of extracted insight **226**. Protected insight **262** may be the resulting values from processing formula **254** based on the data requirement **254** for extracted insight **226**. Protected insight **262** may include the value of extracted insight **226** in which insight encryptor **160** did not execute a corresponding privacy enhancing technique. Privacy preserving credentials may be generated to protect protected insight **262**. Insight encryptor **160** may use data requirement **254** to pass the function input parameters to the selected privacy enhancing technique for extracted insight **226**. Insight encryptor **160** may then process and encrypt extracted insight **226** based on its respective selected privacy enhancing technique.

At **820**, insight encryptor **160** may store protected insight **262** in secure extracted insights database **170**. Protected insight **262** may only be accessible to those permitted under security classification **238** for extracted insight **226**. Insight encryptor **160** may perform insight protection **260** by storing protected insights **262** in secure extracted insights database **170**.

Various embodiments can be implemented, for example, using one or more computer systems, such as computer system **900** shown in FIG. **9**. FIG. **9** is described with reference to FIGS. **1-8**. Computer system **900** can be used, for example, to implement method **800** of FIG. **800**. For example, computer system **900** can implement and execute a set of instructions comprising extract insights from a document **210**, determine a security classification **238** for extracted insight **226**, determine a formula **247** for extracted insight **226**, extract a processing requirement and data requirement from formula **247** for extracted insight, and select a privacy enhancing technique mapped to the security classification and processing requirement for extracted insight **226**. Computer system **900** can be any computer capable of performing the functions described herein.

Computer system **900** can be any well-known computer capable of performing the functions described herein.

Computer system **900** includes one or more processors (also called central processing units, or CPUs), such as a processor **904**. Processor **904** is connected to a communication infrastructure or bus **906**.

One or more processors **904** may each be a graphics processing unit (GPU). In an embodiment, a GPU is a processor that is a specialized electronic circuit designed to process mathematically intensive applications. The GPU may have a parallel structure that is efficient for parallel processing of large blocks of data, such as mathematically intensive data common to computer graphics applications, images, videos, etc.

Computer system **900** also includes user input/output device(s) **903**, such as monitors, keyboards, pointing devices, etc., that communicate with communication infrastructure **906** through user input/output interface(s) **902**.

Computer system **900** also includes a main or primary memory **908**, such as random access memory (RAM). Main memory **908** may include one or more levels of cache. Main memory **908** has stored therein control logic (i.e., computer software) and/or data.

Computer system **900** may also include one or more secondary storage devices or memory **910**. Secondary memory **910** may include, for example, a hard disk drive **912** and/or a removable storage device or drive **914**. Removable storage drive **914** may be a floppy disk drive, a magnetic tape drive, a compact disk drive, an optical storage device, tape backup device, and/or any other storage device/drive.

Removable storage drive **914** may interact with a removable storage unit **918**. Removable storage unit **918** includes a computer usable or readable storage device having stored thereon computer software (control logic) and/or data. Removable storage unit **918** may be a floppy disk, magnetic tape, compact disk, DVD, optical storage disk, and/any other computer data storage device. Removable storage drive **914** reads from and/or writes to removable storage unit **918** in a well-known manner.

According to an exemplary embodiment, secondary memory **910** may include other means, instrumentalities or other approaches for allowing computer programs and/or other instructions and/or data to be accessed by computer system **900**. Such means, instrumentalities or other approaches may include, for example, a removable storage unit **922** and an interface **920**. Examples of the removable storage unit **922** and the interface **920** may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM or PROM) and associated socket, a memory stick and USB port, a memory card and associated memory card slot, and/or any other removable storage unit and associated interface.

Computer system **900** may further include a communication or network interface **924**. Communication interface **924** enables computer system **900** to communicate and interact with any combination of remote devices, remote networks, remote entities, etc. (individually and collectively referenced by reference number **928**). For example, communication interface **924** may allow computer system **900** to communicate with remote devices **928** over communications path **926**, which may be wired and/or wireless, and which may include any combination of LANs, WANs, the Internet, etc. Control logic and/or data may be transmitted to and from computer system **900** via communication path **926**.

In an embodiment, a tangible, non-transitory apparatus or article of manufacture comprising a tangible, non-transitory computer useable or readable medium having control logic (software) stored thereon is also referred to herein as a computer program product or program storage device. This includes, but is not limited to, computer system **900**, main memory **908**, secondary memory **910**, and removable storage units **918** and **922**, as well as tangible articles of manufacture embodying any combination of the foregoing. Such control logic, when executed by one or more data processing devices (such as computer system **900**), causes such data processing devices to operate as described herein.

Based on the teachings contained in this disclosure, it will be apparent to persons skilled in the relevant art(s) how to make and use embodiments of this disclosure using data processing devices, computer systems and/or computer architectures other than that shown in FIG. **9**. In particular, embodiments can operate with software, hardware, and/or operating system implementations other than those described herein.

It is to be appreciated that the Detailed Description section, and not any other section, is intended to be used to interpret the claims. Other sections can set forth one or more but not all exemplary embodiments as contemplated by the inventor(s), and thus, are not intended to limit this disclosure or the appended claims in any way.

While this disclosure describes exemplary embodiments for exemplary fields and applications, it should be understood that the disclosure is not limited thereto. Other embodiments and modifications thereto are possible, and are within the scope and spirit of this disclosure. For example, and without limiting the generality of this paragraph, embodiments are not limited to the software, hardware, firmware, and/or entities illustrated in the figures and/or described herein. Further, embodiments (whether or not explicitly described herein) have significant utility to fields and applications beyond the examples described herein.

Embodiments have been described herein with the aid of functional building blocks illustrating the implementation of specified functions and relationships thereof. The boundaries of these functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternate boundaries can be defined as long as the specified functions and relationships (or equivalents thereof) are appropriately performed. Also, alternative embodiments can perform functional blocks, steps, operations, methods, etc. using orderings different than those described herein.

References herein to "one embodiment," "an embodiment," "an example embodiment," or similar phrases, indicate that the embodiment described can include a particular feature, structure, or characteristic, but every embodiment can not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it would be within the knowledge of persons skilled in the relevant art(s) to incorporate such feature, structure, or characteristic into other embodiments whether or not explicitly mentioned or described herein. Additionally, some embodiments can be described using the expression "coupled" and "connected" along with their derivatives. These terms are not necessarily intended as synonyms for each other. For example, some embodiments can be described using the terms "connected" and/or "coupled" to indicate that two or more elements are in direct physical or electrical contact with each other. The term "coupled," however, can also mean that two or more elements are not in direct contact with each other, but yet still co-operate or interact with each other.

The breadth and scope of this disclosure should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

What is claimed is:

1. A computer-implemented method, comprising:

extracting a plurality of insights from a document;

determining a security classification for at least one of the plurality of insights;

extracting a formula for the at least one of the plurality of insights from text of the document;

identifying a processing requirement and a data requirement corresponding to the formula, wherein the processing requirement specifies a type of operation of the formula, the type of operation being selected from a group that comprises Boolean comparison, numerical comparison, and arithmetic operation, and wherein the data requirement specifies one or more input parameters of the formula;

mapping the security classification and the type of operation specified by the processing requirement to a privacy enhancing encryption technique; and

based on the one or more input parameters specified by the data requirement, executing the privacy enhancing encryption technique corresponding to the security classification and the type of operation specified by the processing requirement for the at least one of the plurality of insights,

wherein at least one of the extracting the plurality of insights, determining the security classification, extracting the formula, identifying, mapping, and executing are performed by one or more computers.

2. The method of claim **1**, further comprising:

segmenting the document using a document segmentation model,

wherein the segmenting is performed by the one or more computers.

3. The method of claim **1**, further comprising:

determining a data classification for the at least one of the plurality of insights,

wherein the determining the data classification is performed by the one or more computers.

4. The method of claim **1**, further comprising:

extracting process related data from the document, wherein the process related data includes data related to terms and conditions of the document; and

determining the formula for the at least one of the plurality of insights based upon at least the process related data related to the terms and conditions of the document,

wherein at least one of the extracting the process related data and determining the formula are performed by the one or more computers.

5. The method of claim **1**, further comprising:

retrieving a plurality of key performance indicators associated with the at least one of the plurality of insights; and

determining the formula for the at least one of the plurality of insights based upon at least one of the plurality of key performance indicators associated with the at least one of the plurality of insights,

wherein at least one of the retrieving the plurality of key performance indicators and determining the formula are performed by the one or more computers.

6. The method of claim **1**, further comprising:

analyzing a regulation policy associated with the at least one of the plurality of insights; and

determining the formula for the at least one of the plurality of insights based upon at least the regulation policy associated with the at least one of the plurality of insights,

wherein at least one of the analyzing and determining the formula are performed by the one or more computers.

7. The method of claim **1**, further comprising:

retrieving a plurality of protected insights, wherein the plurality of protected insights further comprises the at least one of the plurality of insights processed using the privacy enhancing encryption technique corresponding to the at least one of the plurality of insights; and

storing the plurality of protected insights in a database,

wherein at least one of the retrieving the plurality of protected insights and storing are performed by the one or more computers.

8. A system, comprising:

a memory; and

at least one processor coupled to the memory and configured to:

extract a plurality of insights from a document;

determine a security classification for at least one of the plurality of insights;

extract a formula for the at least one of the plurality of insights from text of the document;

identify a processing requirement and a data requirement corresponding to the formula, wherein the processing requirement specifies a type of operation of the formula, the type of operation being selected from a group that comprises Boolean comparison, numerical comparison, and arithmetic operation and wherein the data requirement specifies one or more input parameters of the formula;

map the security classification and the type of operation specified by the processing requirement to a privacy enhancing encryption technique; and

based on the one or more input parameters specified by the data requirement, execute the privacy enhancing encryption technique corresponding to the security classification and the type of operation specified by the processing requirement for the at least one of the plurality of insights.

9. The system of claim **8**, wherein the at least one processor is configured to:

segment the document using a document segmentation model.

10. The system of claim **8**, wherein the at least one processor is configured to:

determine a data classification for the at least one of the plurality of insights.

11. The system of claim **8**, wherein the at least one processor is configured to:

extract process related data from the document, wherein the process related data includes data related to terms and conditions of the document; and

determine the formula for the at least one of the plurality of insights based upon at least the process related data related to the terms and conditions of the document.

12. The system of claim **8**, wherein the at least one processor is configured to:

retrieve a plurality of key performance indicators associated with the at least one of the plurality of insights; and

determine the formula for the at least one of the plurality of insights based upon at least one of the plurality of key performance indicators associated with the at least one of the plurality of insights.

13. The system of claim **8**, wherein the at least one processor is configured to:

analyze a regulation policy associated with the at least one of the plurality of insights; and

determine the formula for the at least one of the plurality of insights based upon at least the regulation policy associated with the at least one of the plurality of insights.

14. The system of claim **8**, wherein the at least one processor is configured to:

retrieve a plurality of protected insights, wherein the plurality of protected insights further comprises the at least one of the plurality of insights processed using the privacy enhancing encryption technique corresponding to the at least one of the plurality of insights; and

store the plurality of protected insights in a database.

15. A non-transitory computer-readable medium having instructions stored thereon that, when executed by at least one computing device, cause the at least one computing device to perform operations comprising:

extracting a plurality of insights from a document;

determining a security classification for at least one of the plurality of insights;

extracting a formula for the at least one of the plurality of insights from text of the document;

identifying a processing requirement and a data requirement corresponding to the formula, wherein the processing requirement specifies a type of operation of the formula, the type of operation being selected from a group that comprises Boolean comparison, numerical comparison, and arithmetic operation and wherein the data requirement specifies one or more input parameters of the formula;

mapping the security classification and the type of operation specified by the processing requirement to a privacy enhancing encryption technique; and

based on the one or more input parameters specified by the data requirement, executing the privacy enhancing encryption technique corresponding to the security classification and the type of operation specified by the processing requirement for the at least one of the plurality of insights.

16. The non-transitory computer-readable medium of claim **15**, the operations further comprising:

segmenting the document using a document segmentation model.

17. The non-transitory computer-readable medium of claim **15**, the operations further comprising:

determining a data classification for the at least one of the plurality of insights.

18. The non-transitory computer-readable medium of claim **15**, the operations further comprising:

extracting process related data from the document, wherein the process related data includes data related to terms and conditions of the document; and

determining the formula for the at least one of the plurality of insights based upon at least the process related data related to the terms and conditions of the document.

19. The non-transitory computer-readable medium of claim **15**, the operations further comprising:

retrieving a plurality of key performance indicators associated with the at least one of the plurality of insights; and

determining the formula for the at least one of the plurality of insights based upon at least one of the plurality of key performance indicators associated with the at least one of the plurality of insights.

20. The non-transitory computer-readable medium of claim **15**, the operations further comprising:

analyzing a regulation policy associated with the at least one of the plurality of insights; and

determining the formula for the at least one of the plurality of insights based upon at least the regulation policy associated with the at least one of the plurality of insights.

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