

A Hybrid Data and Text System for Downgrading Sensitive Documents

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The Problem

- Extensively required for security purposes
- Types of suppressing sensitive information:
 - weak declassification
 - strong declassification
 - downgrading, sanitizing
 - on the fly downgrading, sanitizing, surveillance
- different types of representation: text / data



State of the Art

- Hundreds of declassification rules
- Human implementation of declassification is slow and very costly.
- Downgrading rules are often not even codified.
- No rules for a declassified copy
- So far no work to filter e-mail on the fly



Ontological-Semantic Approach

- Based on computer understanding of the information
- Takes full advantage of the new technologies in computational semantics
- Uses 3 major resources:
 - 1. lexicon (words of a natural language explained in terms of an ontological concept)
 - 2. ontology (a tangled hierarchy of concepts)
 - 3. text-meaning representation (TMR): (composes sentential meaning out of out of ontological concepts)



Defining Illegal Information

- Task of the customer
- Illegal information must be translated into ontological concepts
- e.g. allow mentions of nuclear submarines, not their specific deployment, reactor capacity, or mode of refueling



Minimal Analysis

- Analyzer spots *nuclear submarine*, or even *submarine*
- Analyzer evokes the appropriate lexical entry
- Lexical entry produces the corresponding ontological concept



Minimal Analysis – contd.

submarine

(isa warship)

(theme-of build, commission, decommission, deploy, destroy, attack)

(instrument-of attack, support, transport, threaten)

(manned-by naval crew)

(propel-mode surface, sub-surface)

(engine-type nuclear-engine)

(range $N < x < M$)

(speed $K < y < L$)

(current-location body-of-water and/or geographic point and/or
coordinates

and/or relative, time-range)

(prior-location ...)

(next-location ...)

(current-mission Z)



Minimal Analysis – contd.

- General principles:
 - Most of the slot fillers of concepts are ontological concepts as well
 - Analyzer is interested only in selected slots (e.g. LOCATION), or specific subslots (e.g. CURRENT LOCATION)
 - If the slot is empty, the text will be passed down unmodified
 - Depth of meaning penetration is limited to 3 levels, with a possible enhancement to 5



Problems

- Literal meaning:
 - Generality of the type of illegal information
 - Determining the exact parts to be deleted or replaced
- Non-literal meaning: Inferences, Implicatures, Presuppositions, etc.



Sophisticated Analysis

- For problematic sections:
 - **Full analysis**
but locally restricted to a rigidly circumscribed amount of text
 - **User intervention**
for marked section, i.e. step down from automatic approach



Downgrading the Text

- General Strategies:
 - Suppress any illegal information
 - Keep as much of the original wording as possible when rewording is necessary
 - Keep the changed wording as consistent as possible throughout
 - Make the necessary modifications to make up for any damage done to the text



Downgrading the Text - contd.

- General types of downgrading:
 1. **Deletion:** of one or more lexical items, one or more sentences, one or more paragraphs, etc.
 2. **Replacement:** using a more generic synonym, (taking one or more steps upward in the ontology)
 3. **Addition:** rare, mostly of articles; mainly to compensate for the damage done to the structure of the text by deletions.

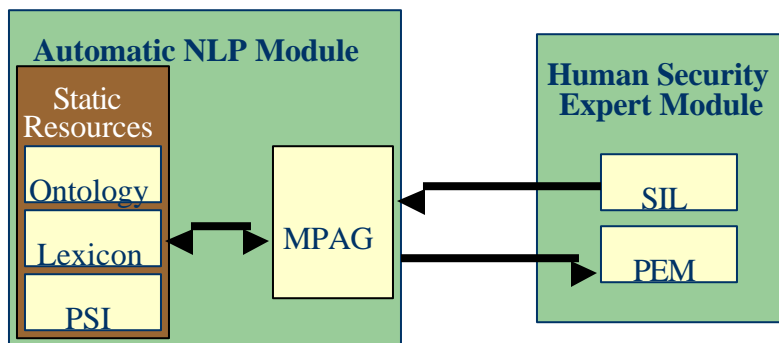


Degree of Automation

- **Manual:**
 - **Defining Illegal Information:** determining what is classified and how it should be treated.
 - (Optional) **Post-Editing:** double-checking that the automatic NLP module below did all right.
- **Automatic:**
 - **NLP Implementation:** all the modifications of the sensitive data as per human definitions above.



Degree of Automation - Graph



PSI: Permitted Substitution Inventory
MPAG: Meaning-preserving Analyzer-Generator
SIL: Sensitive Information List
PEM: Post-editing Module (optional)



Example – Original Text

“I have a dream”

Fivescore years ago, a great American, in whose symbolic shadow we stand today, signed the Emancipation Proclamation. This momentous decree came as a great beacon light of hope to millions of Negro slaves who had been seared in the flames of withering injustice. It came as a joyous daybreak to end the long night of their captivity.

But one hundred years later, the Negro still is not free; one hundred years later, the life of the Negro is still sadly crippled by the manacles of segregation and the chains of discrimination; one hundred years later, the Negro lives on a lonely island of poverty in the midst of a vast ocean of material prosperity; one hundred years later, the Negro is still languished in the corners of American society and finds himself in exile in his own land.



Example – Downgraded Version

“I have a dream”

In the past, many great Americans, in whose symbolic shadows we stand today, signed important documents. These momentous decrees came as a great beacon light of hope to millions of oppressed citizens who had been seared in the flames of withering injustice. They came as a joyous daybreak to end the long night of their captivity.

But today, the oppressed citizen still is not free; today, the life of the oppressed citizen is still sadly crippled by the manacles of segregation and the chains of discrimination; today, the oppressed citizen lives on a lonely island of poverty in the midst of a vast ocean of material prosperity; today, the oppressed citizen is still languished in the corners of American society and finds himself in exile in his own land.

