Guidelines for annotation

Introduction

Selection and Design of entity classes

The main purpose of creating these guidelines to develop training data for models which can help better the identification and care of patients. The overarching principle is to annotate words and expressions as if in clinical reality.

The chosen classes and rules for priorities etc. are made in a attempt to balance identification of significant information for the patients medical history with continuity and and high inter annotator agreement. Class definitions are in part based on SNOMED CT definitions for findings and disease.

Intended Users

These guidelines are intended to be used primarily by clinicians with experience in reading and writing patient records.

Annotation of medical text do usually come with the requirement of some expertise and some explanations may therefore seem arcane when it comes to medical issues as they are keep short for brevity assuming medical knowledge.

Guideline Creation Method

The aim is to create annotation guidelines which can be revised without breaking and handle exceptions. Principles and some syntax of object-oriented programming is used to help build such a system. The guidelines are built from the bottom up from definitions and axioms, taking inspiration from logics and mathematics. A **definition** is held to be true in all contexts. It cannot be modified by further rules or exceptions. **Axioms** are a statements that are taken to be true, either because they are self evident or because they are established principles. We use them here as statements that in the setting of clinical text mining are taken to be true intendent of specific annotation task. **Rules** are statements which can be applied under given circumstances to handle errors and exceptions, or modify the output of the annotation process. They are not held to be universally true and can modulate each other, that is they are mutable.

When altering the annotation process rules are to be considered first. In this way the base of the annotation process can remain intact and not break if the desired output of annotation is changed.

Abbreviations

NE = Named Entity; Pat. = Patient, SYM = symptom when referred to as a NE, respective FND for finding and NEG for negation. Def = Definition

Conventions used in the guidelines

- NE will be marked in text before the entity within bracets [ ]. If the entity spans more than one token curly bracets { } will be used to mark the start and end of span, e.g. [SYM]{Headache}

- Comparison expression such as smaller than < and equal to == are sometimes used when they aid readability.

ISSUES

- Guidelines are somewhat inconsistent in syntax
- Hur är vi inkluderande från börjar så att vi inte tappar exempel.
    - Smärtproblematik – vill kunna dela upp senare.

Future development

Using definitions from SNOMED CT could help extend the guidelines while keeping compatibility. Some interesting things defined are:

- *Observable Entities. "The name of something that can be observed and represents a question or assessment which can produce an answer or result (e.g. | systolic blood pressure|, |color of iris|, |gender|. For example, color of nail is an observable entity. Gray nails is a finding.*
- Disorders

There is also guides to mapping from ICD to SNOMED which could be of interest

Definitions & Axioms

Summary

- Words and expressions that are NE are to be marked as belonging to one of the following
    - *Symptom*: Subjective experience by the patient
    - *Signs*: A sign may be observed by another than the pat. or may be detected during anamnesis or medical examination. They are to some degree objective indications of a disease, injury, or abnormal physiological state.
        - In Swedish: classically written under the heading of "akutellt"
    - *Negation*: Negerande enskilda ord såsom inte och ej + förled så som o i t.ex.
- Continuity: All instances of a NE which has the same function shall be labeled in the same manner across the corpus
    - E.g. negations should be categorized as such not only at symptoms but across the document.

Definitions

def 1: Medical observations

A medically relevant **observation** with noticeable effect on the patient is either a **symptom** or a **finding**

def 2: Absence of Observation

The absence of an entity as defined by **def 1** is not a **symptom** or **finding**

def 3: Findings

If entity as defined by **def 1** is noticed from an observation made by a physician (or other medical personnel) and/or is the result of a medical examination of the patient it is a **finding**

def 4: Symptoms

If def 1 is apparent to the patient from the subjective experience induced by def 1 to the patient, it is a **symptom**

def 5: Negations

A **negation** is any construction which inverts or denies the default meaning of a word or statement that it affects.

def 6: Entities Span

A named entity is a single OR sequential set of full tokens, i.e. only whole words and without leaps.

See spans of influence and compound words for example usage

Axioms

Axiom 1: Context

The meaning of words and expressions defined by their natural or simulated context.

I.e. they should be interpreted as in a clinical context when written in a health record and at the part in which they are written, e.g. status or anamnesis.

Axiom 2: Who can make a finding

A **finding** can only be defined by someone with the adequate medical expertise

Axiom 3: Negated entities

In cases where entity and negations are separable entities are defined firstly without context in regards to negations, e.g. in:

Ingen smärta

The pain is judged before the negation is taken into consideration and is therefore a symptom and not the absence of a symptom, see. def 2.

Axiom 4: Shortest possible statement

The shortest possible statement that still adequately describe the finding or symptom is the entity. Therefore modifiers should be omitted if possible, e.g:

"beating [sym]{headache}"

"large [FND]{swelling on side of nose}"

In the second example "on side of nose" is a modifier of the root finding "swelling", but it is essential to fully describe the finding as swelling somewhere else could mean something entirely different. Compare to "headache on left side of the head"; the variations on headache are limited enough that it should be considered an entity in itself, i.e. it contains enough information to be self contained.

This will be a decision that has to be made by the annotator, which add to the requirements of expertise

Axiom 5: Temporal Aspect of Finding and Disease

if a finding can be classified as a disease, which is a abnormal conditions that are not momentary and that have an underlying pathological process, it is defined as a finding when discovered and when reported from previously known information it is not a finding, e.g.

"Röntgen: Röntgen visar distal [FND] radiusfraktur med acceptabelt läge, minimalt disolocerad."

"Bedömning: Distal radiusfraktur, minimaldislokation"

- May be normal (but not necessarily)
- May exist only at a single point in time (e.g. a serum sodium level)
- Cannot be temporally separate from the observation (one cannot observe them and say they are absent, nor can they be present when they cannot be observed)
- Cannot be defined only in terms of an underlying pathological process that is present, when the observation itself is not present

Axiom 6: Continuity

Two entities that are equal to the patient are equal to each other and should therefore be annotated as the same entity class,

Rules

Rule 1: Symptom has priority over finding

if an observation can be defined as both symptom and finding in it's context, symptom has priority.

- SYM > FND

Rule 2: Ambiguity AND/OR Nestlings that are Irresolvable

If no clear meaning can be discerned AND/OR no annotation can be made that follows all definitions and axioms no annotation is to be made, e.g:

"AT: Ligger på britsen, somnar snabbt undan men tittar upp vid tilltal. Hel och ren."

Here a finding could perhaps have been that the patient was drowsy or sleepy, however, no annotation which truly confers this meaning can be made. The meaning of the

Rule 3: Assertions

No differentiation is to be made for different levels of certainty in assertions.

Explanation: When stating findings there are often assertions, of which negations are a type. Statements will range in degrees of certainty and also polarity (Affirming/Rejecting)

- has atrial fibrillation (A-fib)
- it's highly probable that the patient has A-fib
- It is possible that the patient has A-fib
- A-fib cannot be rejected
- No support for A-fib
- A-fib can be rejected

This example was adapted from Velupillai, S. (2012). Shades of Certainty: Annotation and Classification of Swedish Medical Records. PhD thesis, Stockholm University)

This is often more prevalent when describing diseases and hypothesis about diseases, where many negations are used.

Use Cases & Examples

COMPOUND EXPRESSIONS

Negations

Status: AT: opåverkat i vila

At this point "opåverkad" falls under def 2. and is therefore neither symptom or finding.

Here transforming all "opåverkad" to "ej påverkad" helps with automatically tagging the negations using's string matchers. This could be done in preprocessing in a later stage.

"påverkad i vila" = SYM "o" = NEG

Symptoms & Findings

"Smärtpåverkad" is usually a finding whereas the experience of pain "smärta" is a symptom

SPANS of INFLUENCE

"Ingen smärta vid miktion buksmärta eller ÖHN symptom"

The negation refers to both pain at mictuation and "ÖHN symptom". The conjugation of "ingen" would change if the sentence was uncompounded.

"Ingen smärta vid miktion. Ingen buksmärta. Inga ÖHN symptom"

Given this it would be

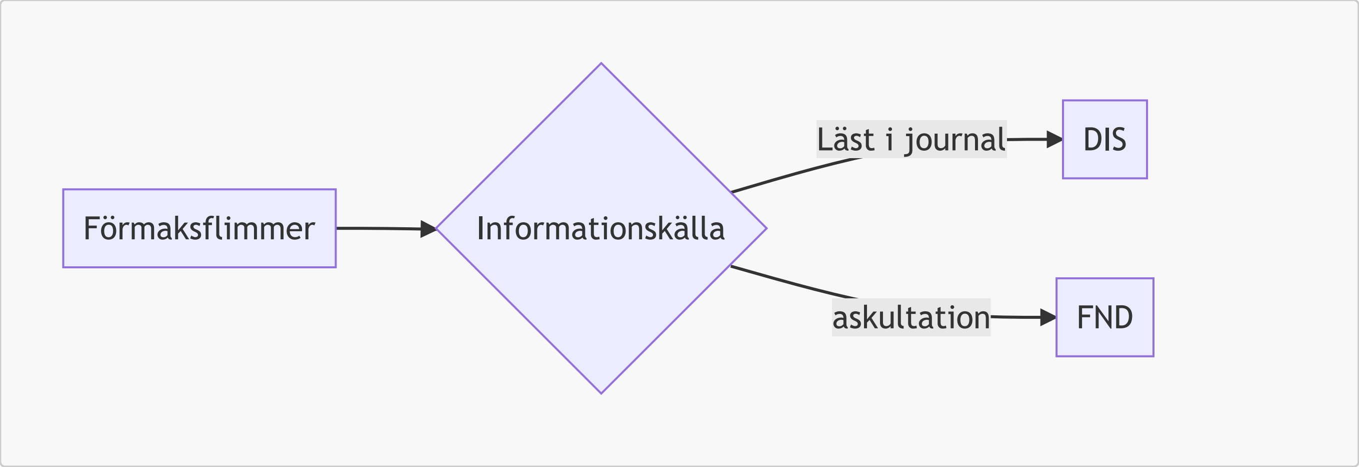
"[NEG] Ingen [SYM] smärta vid miktion. [NEG] Ingen [SYM] buksmärta. [NEG] Inga [SYM] ÖHN symptom"

To best reflect this in the original sentance the following annotation should be made

"[NEG] Ingen [SYM]{smärta vid miktion} [SYM] buksmärta eller [SYM] ÖHN symptom"

SOURCE of INFORMATION

External to health record



Internal to health record

Given that there are some conventions for what is written in what part of a health record this information may be used for deciding between SYM and FND, status usually holds findings and anamnesis symptoms.

This may influence, but not decide.

MISSPELLINGS

If the meaning is discernable by annotator it should treat as if spelled correctly.

MEASUREMENTS

Even given pathological measurements they should neither be annotated as SYM or FND.

Measurements should in future revisions be annotated as measurements MSR.

Motivation:

- The judgement of if a measurement falls within def 1 and def 2, that is if it is medically relevant and not only as the absence of a pathological measurement adds greater requirements on the annotator and adds possibilities for errors.
- In addition if classifying the measurements now they cannot easily be updated if changes to reference values are made.

Future

- There are RegEx expressions for extracting measurement values from clinical text. These could perhaps be combined into the model.