Diagnosis Certainty and Progression: A Natural Language Processing Approach to Enable Characterisation of the Evolution of Diagnoses in Clinical Notes

Poster number: 14
Contact details:
alfredo.madrid@salud.madrid.org

Alfredo Madrid[1,3,5], Caitlin Bullin[1], Lifeng Han[3], Judith Andrew[1,3], Warren Del-Pinto[1,3], Ghada Alfattni[1,3], Oswaldo S. Pabón[4], Ernestina M. Ruiz[4], Luis Rodríguez[5], Ana María Aldana[2], Robyn Hamilton[2], Karim Webb[2], Meghna Jani[2], Goran Nenadic[3], William G. Dixon[1,2]

[1]Centre for Epidemiology Versus Arthritis, University of Manchester, Manchester, UK; [2]Department of Rheumatology, Salford Royal Hospital, Salford, UK; [3]School of Computer Science, The University of Manchester, Manchester, UK; [4]Universidad Politécnica de Madrid, Madrid, Spain; [5]Rheumatology Department, and Health Research Institute (IdISSC), Hospital Clínico San Carlos, Madrid, Spain

Introduction

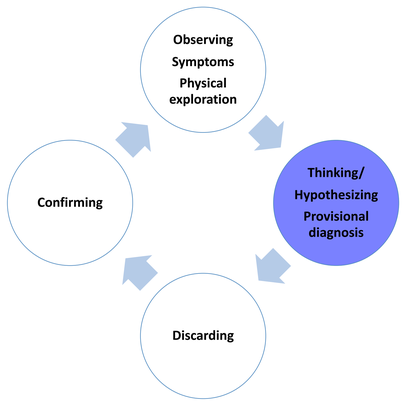
The accurate identification of **diagnoses** in **free clinical narratives** is decisive for characterizing the patients in a medical cohort. Thefore, the **knowledge extraction and information retrieval** tasks must be addressed carefully.

Clinical notes might present **multiple qualifiers** that could change the meaning of a statement: negation, speculation, temporal information, family history and so on.

Sentence	Qualifier	Status
Rheumatoid Arthritis can be ruled out	**Negation**	Discarded
Rheumatoid Arthritis under investigation	**Speculation**	Not confirmed
Family history of Rheumatoid Arthritis	Family member	Not confirmed
Under biologic treatment for Rheumatoid Arthritis	Confirmed	Confirmed

Table 1. Clinical notes qualifiers

It is not unusual for caregivers to **preserve uncertainty using broad and ambiguous terms** when they have not full evidence of the disease status of a patient.



The **percentage** of speculative sentences may range between the **11% and the 22.7%**[1]

It is estimated that **over 40%** of the data in an EHR is stored as free text.

Sample letters

Letter 1

DD
Hospital No. xxxxxxx

Date/Time of Appt: 02 December 2019 at 09:00
Clinic: RHEUMATOLOGY
Type of Appt: New

Rheumatological Diagnosis: Likely rheumatoid arthritis (mildly seropositive, on biologic since 2012)
Previous episodes of episcleritis (x 4)

Non-Rheumatological Diagnosis: Trigeminal neuralgia
Mild Meniere's disease
ETOH excess

Medications: Omeprazole 20mg od
Tramadol 50mg prn
Paracetamol prn
Diclofenac 50mg prn
Hydroxychloroquine 200mg od – to be increased to bd
Adalimumab 40mg every 2 weeks
Fluoxetine 20mg od
Adcal D3 x 1 tablet bd
Gaviscon prn

I had the pleasure of meeting Mr. Linacre at the Community Nutrition and Dietetics outpatient clinic on 1 May 2017, referred by Sugra Bibi, Hospital dietician at St Crispin's Hospital, Donaldstown, DO5 7TP. He attended the community nutrition and dietetics outpatient clinic for review of feeding. Following a stroke Mr. Linacre acquired swallowing difficulties. During a recent admission to hospital Mr. Linacre was established on PEG tube feeding. The feeding tube insitu is a 15French PEG tube placed 05/04/17. The regimen being: 1000mls Energy Multifibre Feed at 100mls/hours for 10 hours (9am-7pm) with 1400mls water given as divided flushes (e.g. 10x140mls) throughout the day e.g. before and after feed and with medications.

Yours faithfully,

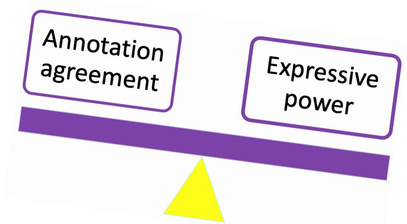
Image 1. Clinical notes with speculation qualifier

Objectives

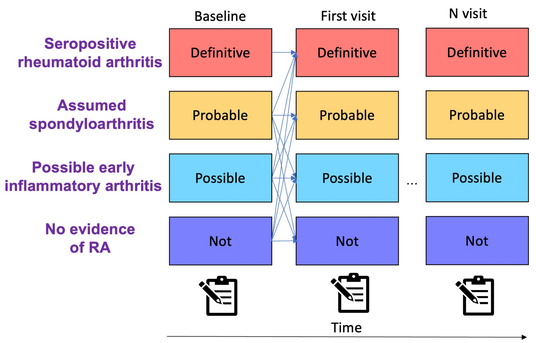
1. To appropriately identify the **uncertainty and negation qualifiers** in Rheumatic and Musculoskeletal narratives building a **classification model** that handles four different categories: **Definitive, probable, possible, not**
2. To demonstrate the extent to which that influences possible population health research about **incidence/prevalence** of disease and its evolution

Levels of speculation

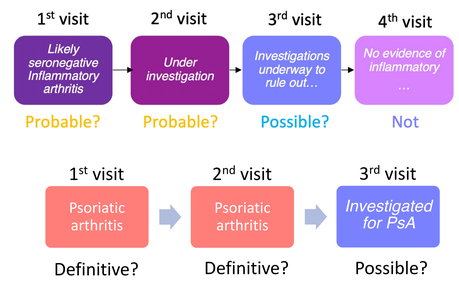
More annotation classes lead to **lower agreement results**. Less granular models **lose expressive power** [2]



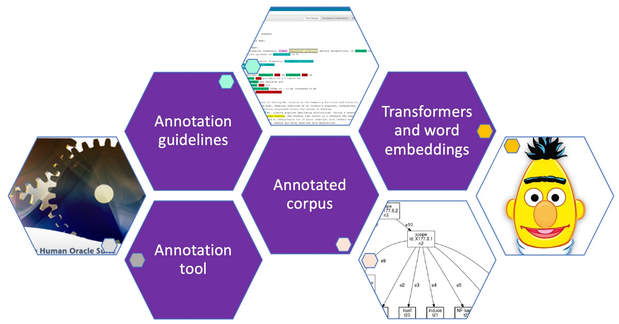
A **binary classifie**r is good for identification but don't allow us to characterize the speculation evolution over clinical notes.



Examples

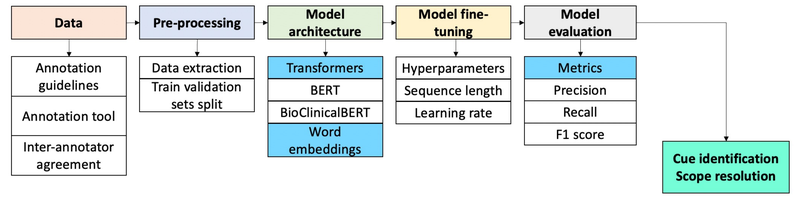


NLP and text mining



Roadmap

Annotation guidelines, and definition of the four different categories: Definitive, Probable, Possible, Not.
Manual annotation of clinical notes by a physician: *eHost, spreadsheet*
Inter-annotator agreement measure with a subset of clinical notes
Enriching dataset with *Probable* and *Possible* cases
Word embeddings + classification model: Snomed2Vec
Transformers models: BioClinicalBert, MedBert
Cue identification and scope resolution: Precision, recall, F1-Score



References

[1]Cruz Díaz, N. P., & Maña López, M. J. (2019). Negation and Speculation Detection (Vol. 13). John Benjamins Publishing Company. https://doi.org/10.1075/nlp.13
[2]Velupillai, S. (2012). *Shades of certainty: annotation and classification of swedish medical records* (Doctoral dissertation, Department of Computer and Systems Sciences, Stockholm University).