

Vaccinarea Covid în România

KBS 2021

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Calculatoare
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OBJECTIVE

STUDIAREA VACINĂRII PRIN ANALIZA:

- Reacțiilor adverse ce pot exista în cazul vaccinării cu un anumit ser, ținând cont de starea de sănătate a pacientului.
- Unor aproximări ale datelor de vaccinare.
- Corelarea numărului de vaccinări cu numărul de cazuri pozitive pe zi.

Introdurre

MOTIVAȚIE

În prezent, cea mai simplă și viabilă posibilitate de a stopa pandemia de Covid este prin vaccinare. Scopul acestei ontologii este de a modela și analiza procesul de vaccinare pe teritoriul României.

Exemple de întrebări:

- ◇ Câte tipuri de vaccin sunt disponibile?
- ◇ Care sunt reacțiile adverse posibile în urma vaccinării cu AstraZeneca?

Popularea Ontologiei

POPULAREA AUTOMATĂ ȘI PARSAREA DATELOR

Datele sunt preluate sub form de JSON de pe site-ul datelazi.ro, iar acestea conțin informații referitoare la situația vaccinării pe fiecare județ. Pentru parsarea fișierului, am utilizat un script de Python care scrie instrucțiunile necesare populării ontologiei sub formă de text.

Interogări

EXEMPLE

- ◇ Care sunt reacțiile adverse posibile în urma vaccinării cu AstraZeneca?
- ◇ Care sunt vaccinurile pe bază de mARN ?
- ◇ Este AZ un vaccin pe bază de vector viral ?
- ◇ Cu ce vaccin ar trebui persoana X să se vaccineze ?

```
(RETRIEVE (?X) (AND (?X SIDEFFECT) (AZ ?X HAS-SIDE-EFFECT))) --> (((?X BLOOD-CLOT)))
```

```
(RETRIEVE (?X) (AND (?X VACCINE) (?X ARN-BASED HAS-TYPE))) --> (((?X PFIZER)))
```

```
(INDIVIDUALS-RELATED? AZ VIRAL-VECTOR HAS-TYPE) --> T
```

Role VACCINATE-WITH exists in TBox COVID-KBS. Assuming you are

```
(INDIVIDUALS-RELATED? RARES VIRAL-VECTOR VACCINATE-WITH) --> T
```

RACER CODE

```
; Q1 : Câte tipuri de vaccin sunt disponibile?

(evaluate (length (retrieve-concept-instances
  | 'Vaccine (current-abox) (all-individuals))))

; Q2 : Care sunt județele cu incidență mai mare de 0.5?

(concept-instances (and County (>= has-incidence 0.5)))

(retrieve (?x (has-incidence ?x) (told-value (has-incidence ?x)))
  | (?x (and County (an has-incidence) ( > has-incidence 0.5))))

; Q3 : Care sunt reacțiile adverse posibile în urma vaccinării cu AstraZeneca?

(retrieve (?x)
  | (and (?x SideEffect)
    | | (az ?x has-side-effect)))

; Q4 : Care sunt vaccinurile create pe bază de arn viral?

(retrieve (?x )
  | (and (?x Vaccine)
    | (?x arn-based has-type)))

(individuals-related? az viral-vector has-type)
[(individuals-related? Rares viral-vector vaccinate-with)]

(concept-instances Person)
(concept-instances Male)
(concept-instances Female)
(concept-instances County)
(concept-instances Teenager)
```

DB-PEDIA SPARQL QUERY

Am utilizat DP-Pedia pentru a extrage date legate de demografia județelor din România. Query-ul folosit este urmatorul:

```
;sparql query to get counties pop
PREFIX category: <http://dbpedia.org/resource/Category:>
PREFIX skos: <http://www.w3.org/2004/02/skos/core#>
PREFIX page: <https://dbpedia.org/page/>

select distinct(?county) ?population where {
    ?county dbo:type ?type.
    ?county dbo:populationTotal ?population.
    FILTER(?type = dbr:Counties_of_Romania)
}
```

DL-Learner

LEARNING PROBLEM

Pentru a utiliza DL-Learner, am convertit ontologia în format OWL folosind comanda 'save-kb'. Problema pe care dorim să o implementăm este următoarea: "Predicting whether the number of cases will be high(positive class) or low(negative class) based on population and percentage of vaccinated people".

LEARNING PROBLEM

```

cmd
Initializing component 'lp' of type PosNegLStandard ...
... initialized component 'lp' in 0ms. Status: OK
Initializing component 'alg' of type GdlClassExpressionLearner ...
... initialized component 'alg' in 50ms. Status: OK
Running algorithm instance 'alg' (OCCL)
Starting top down refinement with: Thing (13.04M accuracy)
more accurate (21.74%) class expression found: has-vaccinated some double[<= "11.0""double]
more accurate (91.308%) class expression found: (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double])
more accurate (100.00%) class expression found: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "17.4""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double])
Maximum time (10 seconds) reached, stopping now...
Solutions (at most 20 are shown):
1: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "11.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
2: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "12.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
3: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "12.6""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
4: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "13.2""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
5: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "14.4""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
6: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "15.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
7: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "16.5""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
8: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "16.9""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
9: ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "17.4""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 15, depth 1)
10: County and ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "17.4""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
11: ((County and (has-pop some double[<= "659446.0""double])) or (has-vaccinated some double[<= "17.4""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
12: ((County and (has-vaccinated some double[<= "17.4""double])) or (has-pop some double[<= "659446.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
13: County and ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "16.9""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
14: ((County and (has-pop some double[<= "659446.0""double])) or (has-vaccinated some double[<= "16.9""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
15: ((County and (has-vaccinated some double[<= "16.9""double])) or (has-pop some double[<= "659446.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
16: County and ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "16.5""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
17: ((County and (has-pop some double[<= "659446.0""double])) or (has-vaccinated some double[<= "16.5""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
18: ((County and (has-vaccinated some double[<= "16.5""double])) or (has-pop some double[<= "659446.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
19: County and ((has-pop some double[<= "659446.0""double]) or (has-vaccinated some double[<= "15.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
20: ((County and (has-pop some double[<= "659446.0""double])) or (has-vaccinated some double[<= "15.0""double])) and (has-vaccinated some double[<= "17.4""double]) and (has-vaccinated some double[<= "21.6""double]) (accuracy 100%, length 17, depth 1)
Algorithm stopped (3098 descriptions tested).

```

Verbalizarea Ontologiei

DL2NLP

Pentru a verbalisa ontologia, am utilizat un tool scris în Prolog.

Tool Utilizat:

`https://github.com/Kaljurand/owl-verbalizer` După
rularea scriptului utilizând SWI-Prolog, rezultatele sunt scrise în
fișierul `natural_language.out`.

EXEMPLU

- ◇ Every JOB is something that is an ESSENTIAL-JOB or that is a MEDICAL-JOB or that is an OTHER-JOB.
- ◇ Every PERSON is something that is an ADULT or that is a CHILD or that is a SENIOR or that is a TEENAGER.
- ◇ Every PERSON is something that is a FEMALE or that is a MALE.
- ◇ Everything that is a FEMALE or that is a MALE is a PERSON.
- ◇ No FEMALE is a MALE.

Concluzii

CONCLUZII

Aspecte pe care le-am acoperit cu Ontologia:

- ◇ Asignarea fazei de vaccinare pentru fiecare persoană, pe baza vârstei și ocupației.
- ◇ Recomandarea de vaccinuri în funcție de grupa de vârstă.
- ◇ Prezicerea incidenței(mare/mică) pe baza populației unui județ.

Vă mulțumim pentru atenția acordată!