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Pictographs

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# A Concept-based Approach for Translation of Medical Dialogues into Pictographs



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## BACKGROUND

Part of the SNF **PROPICTO** project  
"Projection du langage oral vers une forme pictographique"

Aim: developing a **speech-to-pictographs translation system** for French medical dialogues: **PictoDr**

- Concept-based approach using a UMLS gloss
- Designed for non-French speakers or patients with cognitive impairments
- Using original and modified **ARASAAC**<sup>1</sup> pictographs

<sup>1</sup> Pictograms author: Sergio Palao. Origin: ARASAAC (<http://www.arasaac.org>). License: CC (BY-NC-SA). Owner: Government of Aragon (Spain)

## 2 STEP APPROACH

Utterance paraphrases

"La douleur abdominale est plus forte après manger ?"  
(Is the abdominal pain stronger after eating?)  
"Quand vous mangez, après ça fait plus mal dans le ventre?"  
(When you eat, does it hurt more in your stomach afterwards?)

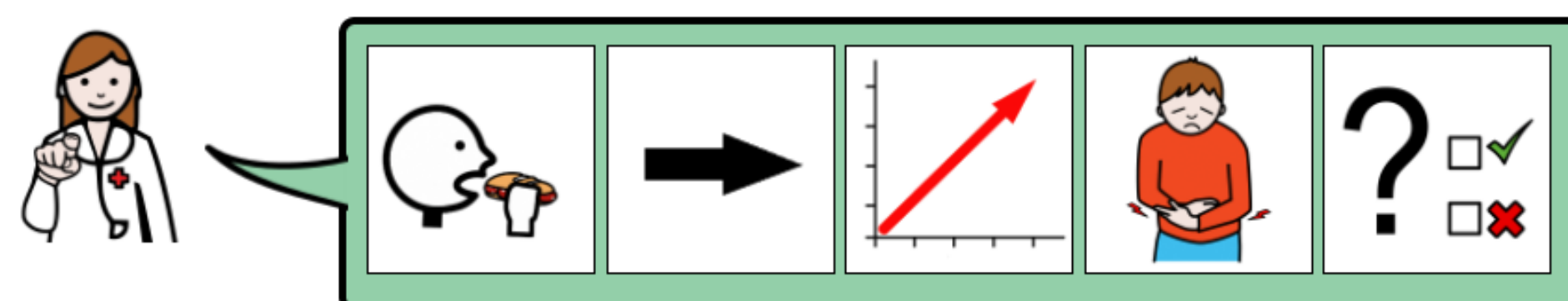
1 NMT

UMLS gloss

You Agent CUI: n/a	Eating Organism Function CUI: C0013470	Causes Relation CUI: n/a	Increase Functional Concept CUI: C0442805	Abdominal Pain Sign or Symptom CUI: C0000737	Question Mode CUI: n/a
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2 Mapping

Pictographs



Demo & more info:

<https://propicto.demos.unige.ch>  
johanna.gerlach@unige.ch

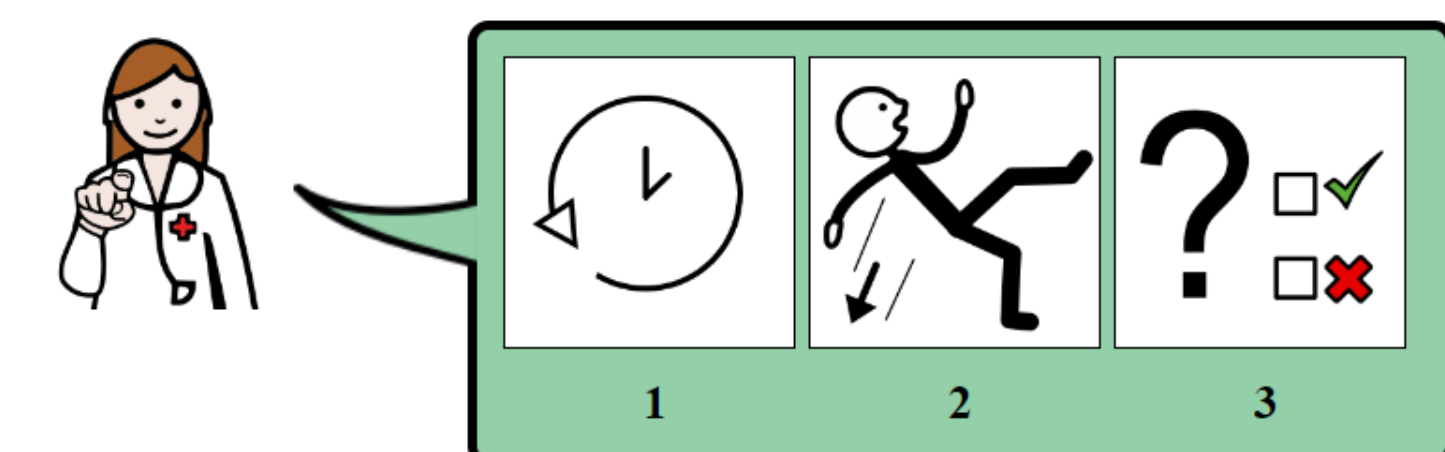


## EXAMPLES

"Est-ce que vous êtes tombé ?"

(Did you fall?)

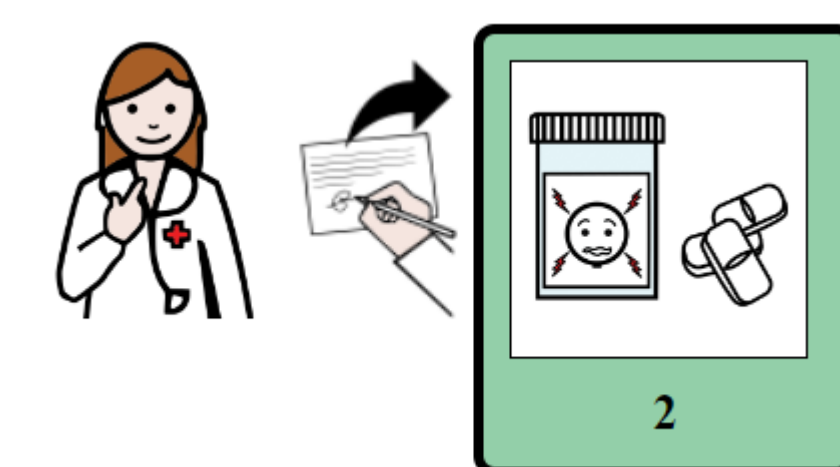
You | Past history of | Falls | Question



"Je vais vous donner des médicaments contre la douleur."

(I will give you medication for the pain.)

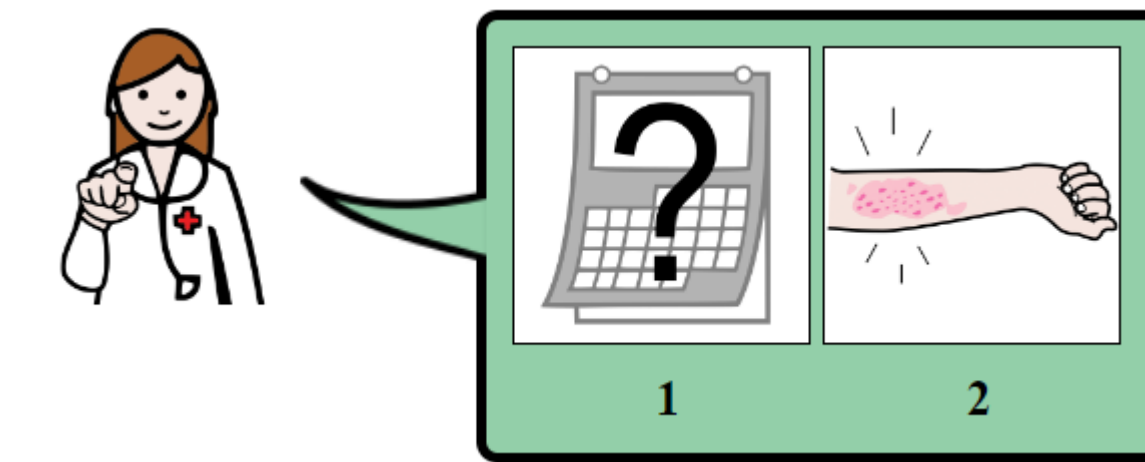
I | Prescription procedure | Analgesics



"Quand est-ce que les rougeurs sont apparues ?"

(when did did the redness appear?)

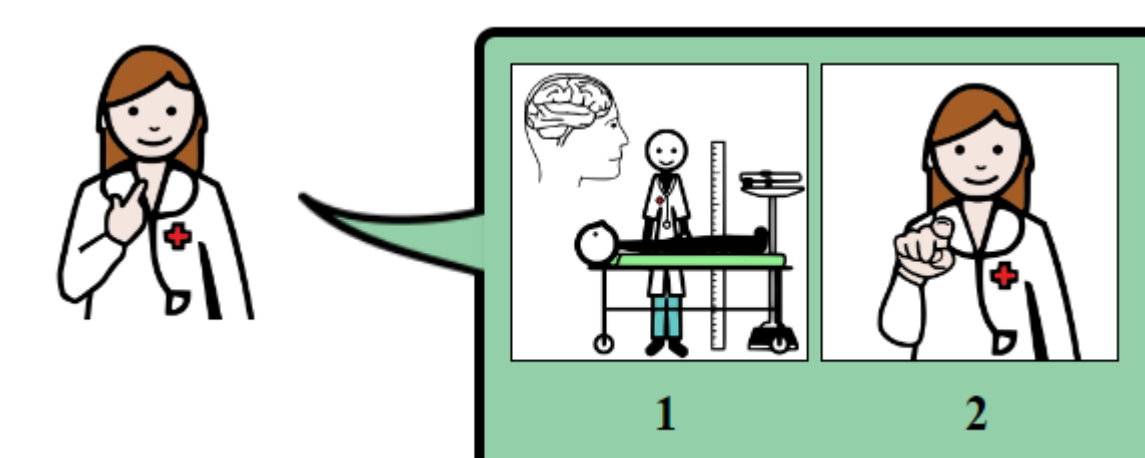
Date in time | You | Skin lesion | Question



"Je vais faire un examen neurologique."

(I will do a neurological examination)

I | Neurologic Examination | You



## RESOURCES & TRAINING DATA

```
{ "paraphrases": [
  "vous êtes-vous (blessé|blessée) (au niveau du|sur (le|votre)|au) visage",
  "did you injure ?(yourself) (in the area of|on) (the|your) face",
  "$avez_vous (une blessure|des blessures) ?(quelque part) (au niveau du|sur (le|votre)|au) visage",
  "did you suffer (an injury|injuries) ?(somewhere) in (the|your) facial area"
],
  "umlsGloss": [
    {"semType": "Agent", "concept": "You", "cui": ""},
    {"semType": "Finding", "concept": "Past history of", "cui": "C0332119"},
    {"semType": "Injury or Poisoning", "concept": "Injury wounds", "cui": "C0043250"},
    {"semType": "Body Location or Region", "concept": "Face", "cui": "C0015450"},
    {"semType": "Mode", "concept": "Question", "cui": ""}
  ]
}
```

Artificial parallel data generated from CFG grammar:  
source variation <> semantic gloss  
600k sentences

## AIMS

FR  
UMLS  
semantic  
gloss

Compare neural machine translation approaches for **translation into UMLS semantic gloss**

UMLS  
semantic  
gloss

Evaluate suitability of **UMLS semantic gloss as pivot** for translation into pictographs

## NMT SYSTEMS

- Standard Transformer encoder-decoder architecture
- Baseline trained from scratch vs. pre-trained encoders

	#Param	#Vocab	#Data	
Baseline	196M	32k	-	trained from scratch with artificial data using OpenNMT
CamemBERT	196M	32k	138GB	FR part of OSCAR
FlauBERT	224M	50k	71GB	div. FR corpora
DrBERT	196M	32k	7GB	Healthcare domain data
XML-R	360M	250k	2.5TB	Multilingual, > 100 languages

## EVALUATION DATA

Dialog data collected at HUG in real triage settings

	HUG1	HUG2
# sentences	1,252	380
# out of training	993	320
# in training	259	60

## Evaluation 1 - NMT TO UMLS GLOSS

Automatic evaluation: comparison with references

- Using weighted F-measure to account for precision & recall
- F0.5 3-best : weighted average of score for 3-best system outputs

	HUG1		HUG2	
	F0.5	F0.5 3-best	F0.5	F0.5 3-best
Baseline	69.71	67.14	67.63	64.26
CamemBERT	<b>94.32</b>	86.79	<b>86.71</b>	79.15
FlauBERT	91.73	84.51	84.39	77.75
DrBERT	93.12	86.11	85.11	78.49
XML-R	93.79	82.73	85.94	75.17

Human evaluation:

	Eval. 1	Eval. 2	Agree	
Sentences where output does not match references	Same	32	32	29
2 HUG physicians asked to compare meaning of system output vs reference	Similar	13	19	11
	Different	10	5	5
	I don't know	1	-	-
Only results from CamemBERT & HUG2	Total	56	56	45

## Evaluation 2 - UMLS GLOSS AS PIVOT

- Human evaluation of pictograph sequence produced from UMLS gloss
- HUG2 corpus > unique glosses > 147 sentences
- 4 judgements / sentence

	0%	20%	40%	60%	80%	100%
Translation is correct	YES (57%) NO (21%) NO MAJ.(22%)					
1 or more pictos unnecessary	NO (90%)					
1 or more pictos are missing	NO (97%)					
1 or more pictos are incorrect	NO (98%)					
I don't understand 1 or more pictos	NO (87%)					
The order of the pictos is not logical	NO (95%)					

## CONCLUSIONS

- Pre-trained models outperform a baseline trained from scratch
- Larger models don't outperform smaller, more specialized ones
- The abstraction from the original surface form introduced by the pivot is not perceived as a distortion of meaning

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