Technology developed at CLiPS

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Accumulate Industrial Meeting
21 March 2018

Overview

WP2

- Normalization
  - Spelling correction for EN and NL
  - Synonymy discovery (ongoing)
- Terminology extraction
  - Concept disambiguation
  - Concept extraction

WP3

- Event extraction
  - Machine reading comprehension
  - Relation extraction (ongoing)
  - Negation and modality detection (ongoing)

FOCUS OF THIS TALK

Normalization and terminology extraction: a brief recap

Spelling correction

- Context-sensitive
- Available for both English and Dutch
- Fix spelling with embeddings of character n-grams and words in combination with measures of string and phonetic similarity

Concept extraction

- Use UMLS concept definitions
- Concept is chosen based on the match between embeddings of definitions and embeddings of context
- Concept boundaries are obtained with a noun-phrase chunker

Machine reading comprehension

Goal

- Given a document
- Answer questions about that document
  - Focus on analyzing “understanding”

Application in the clinical domain

- Couple with a retrieval component
- Fine-grained QA about background medical knowledge or patients

Passage:

A 22-year-old woman presented to the emergency room with headache and confusion. The symptoms had woken her in the morning and progressively worsened through the day.
...
Neurological examination demonstrated left lower facial paralysis with aphasia, dyscalculia, dyslexia and fingeragnosia, clinically Gerstmann syndrome. Further examination showed no abnormalities. A non-contrast head CT was performed and showed a left parietotemporal venous infarction and a small juxtacortical haemorrhage. An additional MR angiography showed occlusion of the left transverse sinus and a T2-weighted MRI showed a venous infarction with a juxtacortical haemorrhage just beneath the sulcus.

Query:

Upon performing an MRI, an accompanying _____ was found near the bottom of the sulcus.

Answer:

juxtacortical haemorrhage

Source: BMJ Case Reports

What we did

- Created a dataset from clinical case reports
- Automated question construction: gap-filling queries where the answer can be a treatment, a test or a problem
- Analyzed performance of different machine readers
- Examined the required reading skills: in what ways is answering difficult?

Hemorrhagic stroke

CASE REPORT

Intracavitary ultrasound (ICARUS): a neuroendosco adaptation of intravascular ultrasound for intracerebral hemorrhage evacuation

Alexander G Chartrain, Danny Hom, Joshua B Bederson, J Mocco, Christopher Paul Kellner

SUMMARY

Neurosurgeons performing intracerebral hemorrhage evacuation procedures have limited options for monitoring hematoma evacuation and assessing residual hematoma burden intraoperatively. Here, we report the successful neuroendoscopic adaptation of intravascular ultrasound, referred to here as intracavitary ultrasound (ICARUS), in two patients. Pre-evacuation ICARUS demonstrated dense hematomas in both patients. Post-evacuation ICARUS in patient 1 demonstrated significant reduction in clot burden and two focal hyperechoic regions consistent with pockets of hematoma not previously seen with the endoscope or burr hole ultrasound. These areas were directly targeted and resected with the endoscope and suction device. Post-evacuation ICARUS in patient 2 showed significant reduction of hematoma volume without indication of residual blood. ICARUS findings were confirmed on intraoperative DynaCT and postoperative CT 24 hours later. ICARUS is feasibly performed in a hematoma cavity both before and after hematoma aspiration. ICARUS may provide additional information to the operating surgeon and assist in maximizing hematoma removal.

BACKGROUND

Introduction

Intravascular ultrasound (IVUS) is an important imaging modality in the diagnosis and treatment of vascular disease.[1 2] IVUS catheters contain

The introducer is removed and the IVUS cath introduced into the sheath until the tip of the is flush with that of the sheath at the distal e the hematoma. The sheath is retracted (exch a distance equal to the length of the hemo so that the tip of the sheath rests at the pr edge of the hematoma. With the ultrasoun vated, the IVUS catheter is slowly retracted ir sheath to scan the cavity. The process is re after evacuation to visualise any residual hem (figure 1). Of note, the use of IVUS for int itary imaging during ICH evacuation is of and not currently cleared by the Food and Administration.

CASE PRESENTATION

Patient 1

A 39-year-old man with hypertension, di and end-stage renal disease presented with loss of consciousness (LOC), a Glasgow Scale (GCS) of 9, and National Institutes of Stroke Scale (NIHSS) of 16, and was found t a 77 cm³ left-sided ICH (figure 2A). He und endoscopic evacuation 72 hours after syr onset. Baseline ICARUS prior to evacuation d strated a dense hematoma (figure 3A; see supplementary video 1). At the conclusion evacuation, ICARUS was repeated and ide two residual pockets of hematoma (figure 3 C; see online supplementary video 2). Usi information gathered from ICARUS, these p the endoscope and meda, California, US JS not been performa been terminated w idual pockets. Subs demonstrated >909

ocedure

n it be a diagnostic tool for neurologists?

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ted with acute ischaemic stroke with NIHSS 13. She had right eye ptosis and miosis. She and her husband atures were different than usual. With her consent, we compared her face with her pictures on Facebook. In miosis in her pictures, she was diagnosed with acute Horner syndrome. Facebook may be a useful tool for timing of facial neurological signs.

a website with more than 845 users. It has been increasingly tient education, research enrol- behavioural research, and chan- ost of the residents and fellows

not show any published cases d as a diagnostic tool in neur- patient with acute neurological k played a significant role in her

324 mg and clopidogrel 300 mg. She was transferred to neurological intensive care unit for closer monitoring.

In the intensive care unit, she was noted to have right ptosis and mild right miosis with pupil 0.6 mm smaller than the left side (figure 1D). She and her husband were not sure if her facial features were different than usual. We checked her driver's licence but her picture was not clear enough to make a comparison. She had no other pictures with her. We asked her if she had pictures on her Facebook profile to which she responded affirmatively. As our patient was competent to give consent, we asked for her verbal permission to compare her pictures on Facebook with her present facial features to clarify if the eyelid droop was

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Other full case

A 12-year-old boy presenting with unilateral proximal interphalangeal joint swelling

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Summary

Pachydermodactyly is a rare and benign superficial dermal fibromatosis, characterised by asymptomatic soft tissue hypertrophy of the lateral and dorsal aspects of the proximal interphalangeal joints. The majority affected are males, with only a few reported female cases, and usually begins to develop around the age of puberty. Pachydermodactyly affects the second, middle and ring fingers of the hand symmetrically and bilaterally. The majority of reported cases demonstrate bilateral involvement of joints, only a small proportion report unilateral involvement. In this case report the authors review literature and discuss a case of pachydermodactyly presenting a unilateral swelling of the proximal interphalangeal joints of only the left hand in a right-handed young male.

movement of with no other ere were no ints involved.

Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

CASE REPORT

Alveolar bone exostoses subsequent to orthodontic implant placement

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SUMMARY

Alveolar bone exostoses (ABE), also known as a buttress bone formation, are not uncommon to the literature. Although, exostoses in response to the trauma from occlusion are a popular concept proposed more than 45 years ago, still the aetiological factors behind t development are unclear. Various risks and compli associated with orthodontic implants have been published, but buttress bone formation subsequen this procedure has not been reported till date. This article describes a case of ABE, subsequent to the placement of orthodontic mini implants, where aft careful evaluation, resective osseous surgery was performed.

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Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

CASE REPORT

Air Duster abuse causing rapid airway compromise

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Accepted 14 December 2014

SUMMARY

Inhalant abuse is potentially life-threatening and has resulted in many complications such as central nervous system depression, cardiac dysrhythmia and hypoxia. Inhalant abuse causing angioedema is rarely reported in the medical literature. In this report we present a case of rapidly progressive airway compromise following recreational huffing. Our patient required intubation and intensive care unit admission with complete recovery after 5 days. The aetiology of airway compromise is postulated to be due to commonly reported frost bite injury and rarely reported angioedema. To the best of our knowledge this the second case reporting angioedema secondary to huffing Air Duster.

BACKGROUND

Inhaling, or huffing, is common among teenagers and adolescents. However, it can occur in any age group. The side effects can be life-threatening,

inpatient unit the same month as this episode. He admitted to huffing Air Duster, 1 can/day for 3–4 years. The day of admission, he had huffed three cans. At the time of evaluation, the patient was unemployed. He smoked cigarettes, 1 pack/day, and huffed Air Duster, 1 can/day. He denied any alcohol or other substance use. Home medications include fluoxetine at 20 mg/day and buspirone at 15 mg twice daily.

INVESTIGATIONS

Laboratory work was performed on admission to ICU. White cell count was 16 800 cells/µl, with a normal differential and no bands. Electrolytes and blood gas performed following intubation were unremarkable. Owing to the significant swelling, which developed over a short period of time, and a rapidly evolving erythema covering a significant portion of the right neck area, a CT of the neck was done which showed extensive soft tissue swelling with oedema- es over the right side of the upper neck for cellulitis versus angioedema (figure 2).

TIAL DIAGNOSIS

njury is a known adverse event from r Duster. However, it was thought that progression of airway compromise was be due to frostbite injury alone. There is ed case in the literature of angioedema Air Duster inhalation, and this was the ury concern in our patient. Once he was towards the end of the hospitalisation,

BMJ Case Reports

aused by sodium hydroxide

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ABE) were defin rgrowths of buc be delineated fro These are com of lamellar bone bone in larger s can be found for example, ma alveolar exostos gh, the aetiology l odular growths a clinicians believe ernation in respo proposed by Gli Few cases have eveloped subsequ al graft.[2–5]

woman presented to hand wounds. Her a sodium hydroxide t gloves for approxi- e felt a burning sen- mmia and blisters ight tenar eminence mplaints aggravated

and she de On examin covered fal and severa locations (the Dopple blood flow NaOH, quently us tic environ which are caustic sod are a cause entation.[1] consisting the maine ments, the

Reminder of important clinical lesson

CASE REPORT

Conservative management of an abdominal gunshot injury with a peritoneal breach: wisdom or absurdity?

Novel treatment (new drug/intervention; established drug/procedure in new sit

CASE REPORT

Burning mouth syndrome due to herpes simplex virus type 1

Maria A Nagel,[1] Alexander Choe,[1] Igor Traktinskiy,[1] Don Gilden[1,2]

SUMMARY

Burning mouth syndrome is characterised by chronic orofacial burning pain. No dental or medical cause has been found. We present a case of burning mouth syndrome of 6 months duration in a healthy 65-year-old woman, which was associated with high copy numbers of herpes simplex virus type 1 (HSV-1) DNA in the saliva. Her pain resolved completely after antiviral treatment with a corresponding absence of salivary HSV-1 DNA 4 weeks and 6 months later.

BACKGROUND

Burning mouth syndrome is a chronic, burning sensation in the mouth, with no underlying dental or medical cause. The burning sensation can be unilateral or bilateral and is localised to the lips, tongue, hard or soft palate. The prevalence varies from 0.7% to 7% and is seen in up to 18% of postmenopausal women.[1 2] Previous treatment has included antidepressants, cognitive behavioural therapy, analgesics, hormone replacement, α-lipoic acid and anticonvulsants.[3]

CASE PRESENTATION

A previously healthy 63-year-old woman developed a burning sensation in her mouth, localised to the right buccal mucosa and anterolateral two-thirds of the tongue. The burning increased when she brushed her teeth and usually decreased within 10 min. Pain resolved spontaneously after 4 weeks. One year later, burning pain in the same distribution recurred and became constant. Dentists, including an oral surgeon, found no mucosal lesions or other abnormalities. No relief was provided by

zoster virus (VZV),[4] and HSV-1[4] and H performed as previously described.[4] PC cies for VZV, and of herpes simplex vi (HSV-1) and HSV-2 were similar (104 102, respectively), and range of detect three viruses was 10–10⁶ DNA copies p Saliva contained cellular GAPDH an copies of HSV-1 DNA per mL, but n HSV-2 DNA.

TREATMENT

The patient was treated with oral valac three times a day for 10 days, followed clovir, 1 g daily for 1 year.

OUTCOME AND FOLLOW-UP

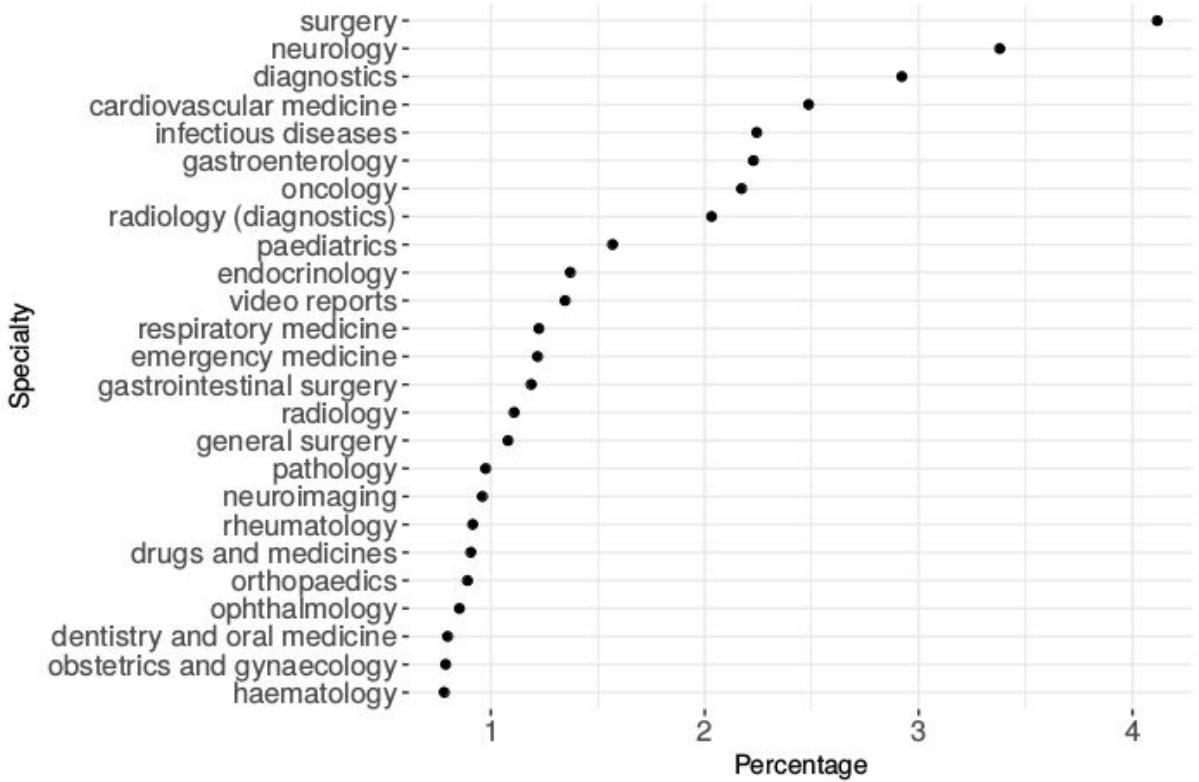
The mouth pain resolved completely wi after antiviral treatment. PCR of saliva 4 6 months after starting antiviral treatme no HSV-1, HSV-2 or VZV DNA. The remained pain free for 1.5 years after di antiviral therapy.

DISCUSSION

No prior reports have associated th mouth syndrome with HSV-1 or any c HSV-1 is a ubiquitous human α-herpe becomes latent in most cranial nerve ga to 70% of individuals.[5] The trigemina which provides sensory afferent innerva face and mouth, is the most common cr ganglion infected.[6] HSV-1 reactivatio causes recurrent cold sores (herpes la ocular disease (herpes keratitis). HSV-1 facial pain and, rarely, encephalitis, a

BMJ Case Reports, (12,000 reports)

25 most common medical specialties:



Reminder of important clinical lesson

CASE REPORT

Conservative management of an abdominal gunshot injury with a peritoneal breach: wisdom or absurdity?

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SUMMARY

Surgical exploration has been the standard of care for abdominal gunshot injuries. The authors report a case of a 28-year-old man who sustained a transabdominal gunshot injury, which entered the anterior abdominal wall and exited adjacent to the T12 vertebra posteriorly with a tangential trajectory. On presentation, the patient was haemodynamically stable with no peritoneal signs. Based on trajectory of the bullet, intra-abdominal injury was suspected. Therefore a CT scan abdomen with intravenous and rectal contrast was performed. The CT scan revealed no extravasation of the rectal contrast but showed free air specks behind the descending colon. Delayed renal images of the left ureter were also normal. Based on the clinical findings, the patient was managed non-operatively with nothing per oral, intravenous antibiotics and frequent abdominal assessments. He made an uneventful recovery without necessitating laparotomy.

BACKGROUND

Gunshot injuries to the abdomen have been traditionally managed by exploratory laparotomy. The dictum of mandatory surgery of all torsogunshots is based on an assumption that only exploration can correctly diagnose all injuries and lower morbidity and that a clinical examination is usually unreliable. This results in a negative laparotomy rate of 15–25%.[1 2] There is recent literature pointing towards selective non-operative management of isolated anterior or posterior abdominal gunshot injury, but to the best of our knowledge no report is available about conservative treatment of transabdominal gunshot injury with a peritoneal breach. A clinical examination and helical CT scan are good tools aiding surgeons in the execution of non-operative management of a select group of patients.

CrossMark

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CASE PRESENTATION

A 28-year-old man was brought to the emergency room within 30 min of a gunshot wound to the abdomen. On presentation, he was vitally stable with no peritoneal signs. On examination, he had sustained a transabdominal gunshot injury, with the entry wound 2 cm above the left anterior superior iliac spine and exit wound just left lateral to the transverse process of T12 vertebra with a tangential trajectory. His systemic examination was normal with no abnormality found on digital rectal examination. The initial management consisted of keeping the patient nothing per oral, catheterisation, intravenous hydration and analgesia. Keeping the bullet trajectory in mind, left colonic and ureteric injury was highly suspected, despite a normal abdominal examination and stable haemodynamics.

INVESTIGATIONS

His complete blood count and serum creatinine remained normal and his haemoglobin and haematocrit did not drop at any point in time.

A CT scan of the abdomen and pelvis was performed with intravenous and rectal contrast including delayed renal films. Images showed specks of free air behind the descending colon with no extravasation of contrast from the rectum and ureter (figure 1).

TREATMENT

A decision was made to manage this patient conservatively based on his haemodynamic stability, absence of peritoneal signs and no contrast extravasation from the colon, ureter or blood vessels on CT scan images. Exploration was kept in mind if the patient showed haemodynamic instability or developed peritoneal signs. He was kept under observation in a high dependency unit where his vitals were monitored hourly along with strict input/output charting and frequent abdominal examinations. He was kept there for 48 h and then shifted to the general ward where he was monitored as per ward protocol. He was fully ambulated on the second day of admission and remained stable throughout the hospital course. A repeat CT scan abdomen with intravenous and rectal contrast on the fifth postadmission day did not reveal any abnormality (figure 2), and therefore he was started on oral liquids followed by a progression to soft diet. He remained stable and was later discharged.

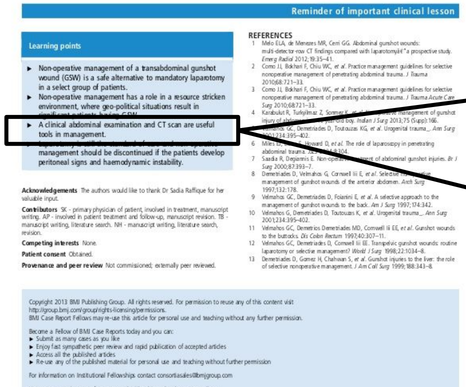
OUTCOME AND FOLLOW-UP

On the 10th day postdischarge, he was followed up in the clinic; he had returned to his normal daily activities and regular diet.

DISCUSSION

Although conservative management of blunt abdominal and stab wound injuries is well

Khan S, *et al. BMJ Case Rep* 2013. doi:10.1136/bcr-2013-201593 1



Reminder of important clinical lesson

Learning points

- Non-operative management of a transabdominal gunshot wound (GSW) is a safe alternative to mandatory laparotomy in a select group of patients.
- Non-operative management has a role in a resource stricken environment, where geo-political situations result in
- A clinical abdominal examination and CT scan are useful tools in management.
- management should be discontinued if the patients develop peritoneal signs and haemodynamic instability.

Acknowledgements The authors would like to thank Dr Sadia Raffique for her valuable input.

Contributors SK - primary physician of patient, involved in treatment, manuscript writing. AP - involved in patient treatment and follow-up, manuscript revision. TB - manuscript writing, literature search. NH - manuscript writing, literature search, revision.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Build queries from Learning points

- Identify medical entities
- Blank out one entity at a time
- Blanked-out entities become ground-truth answers
- Extend the ground-truth answers with synonyms in UMLS

query: *A clinical abdominal examination and __________ are useful tools in management.*

answer: *CT scan (CAT scan, computerized tomography, . . .)*

Experiments

Baseline

- Pick the most frequent concept as answer

Language model

- Kneser-Ney LM to predict the most likely word/concept based on 3 preceding words in the query

Embedding-based

- Pick the concept whose context representation is maximally similar to the context of the query

Experiments

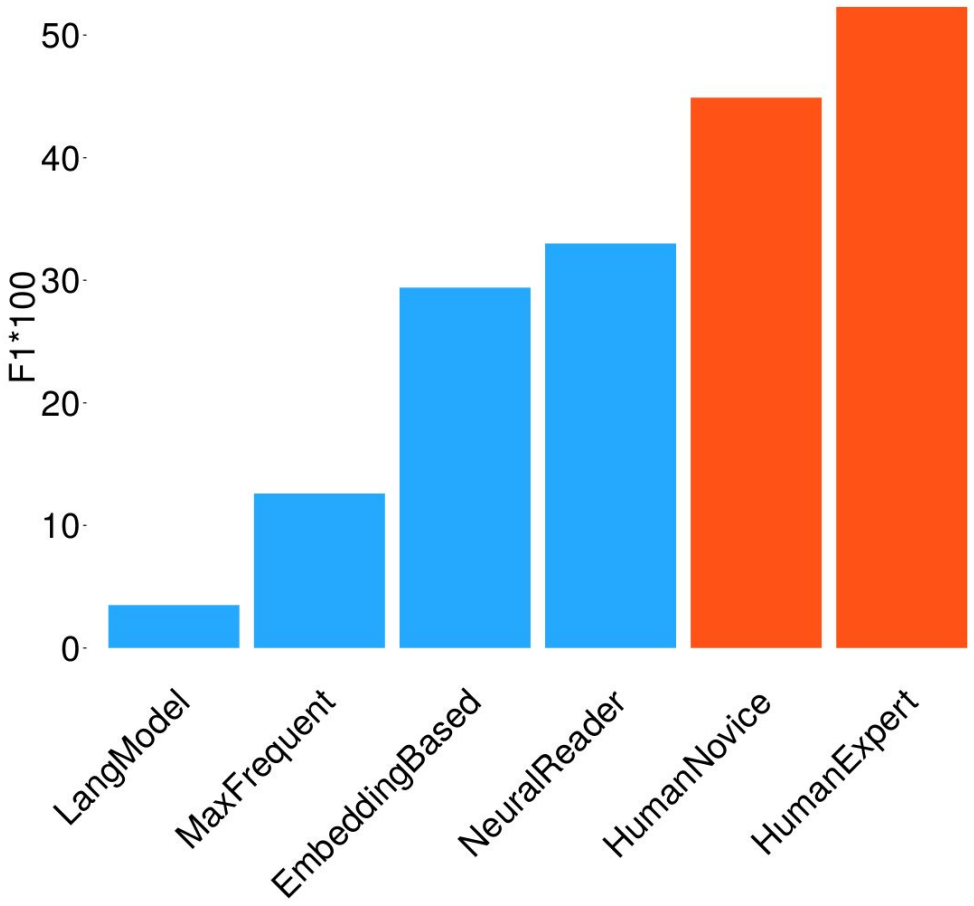
Neural readers

- Recurrent neural nets with attention: contextual representations of tokens in passage and query are built, then their compatibility is compared

Humans

- Answered 100 instances from the development set
- A person with medical background
- A person with no medical background

Results


F1*100
50
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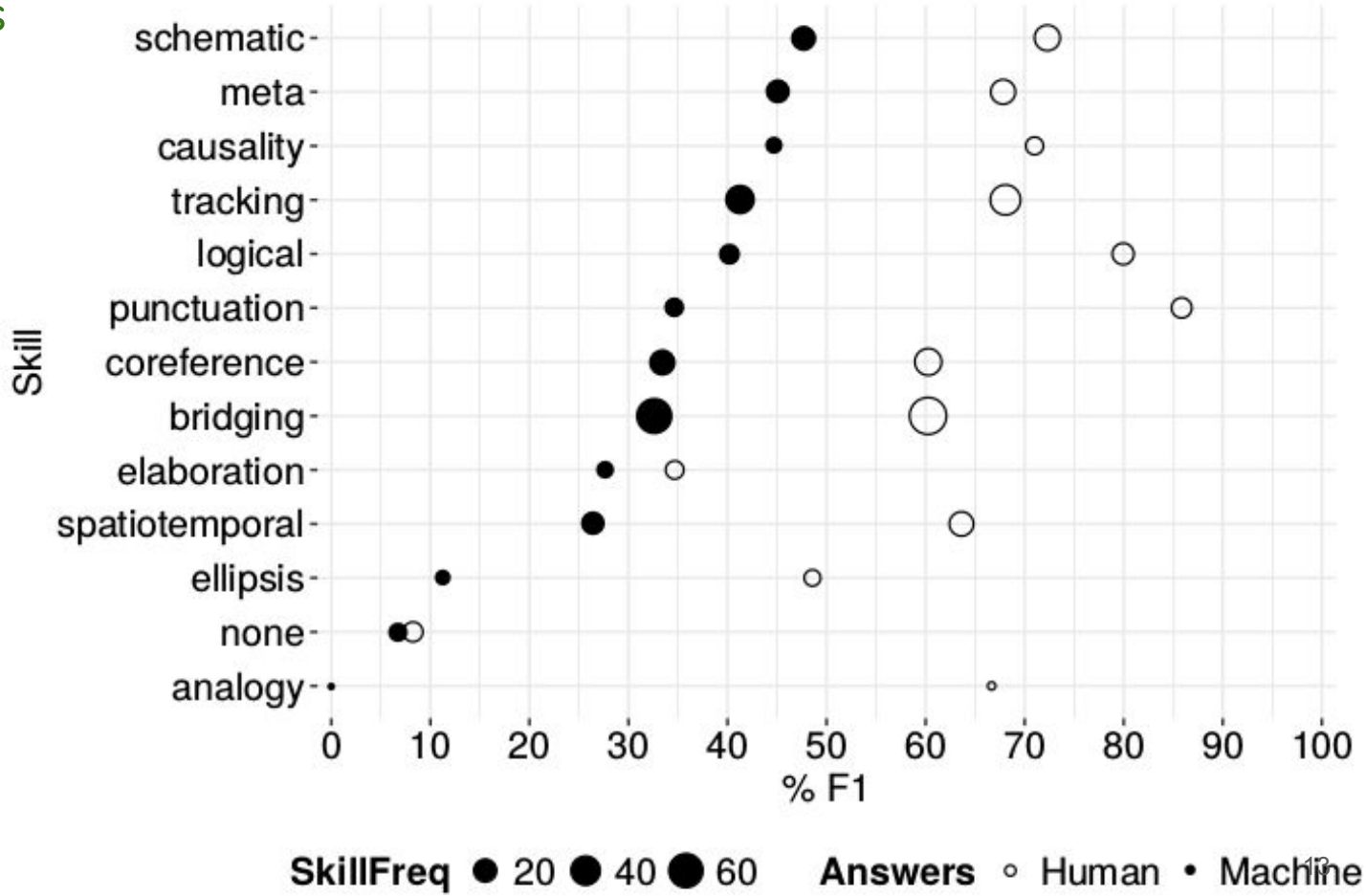
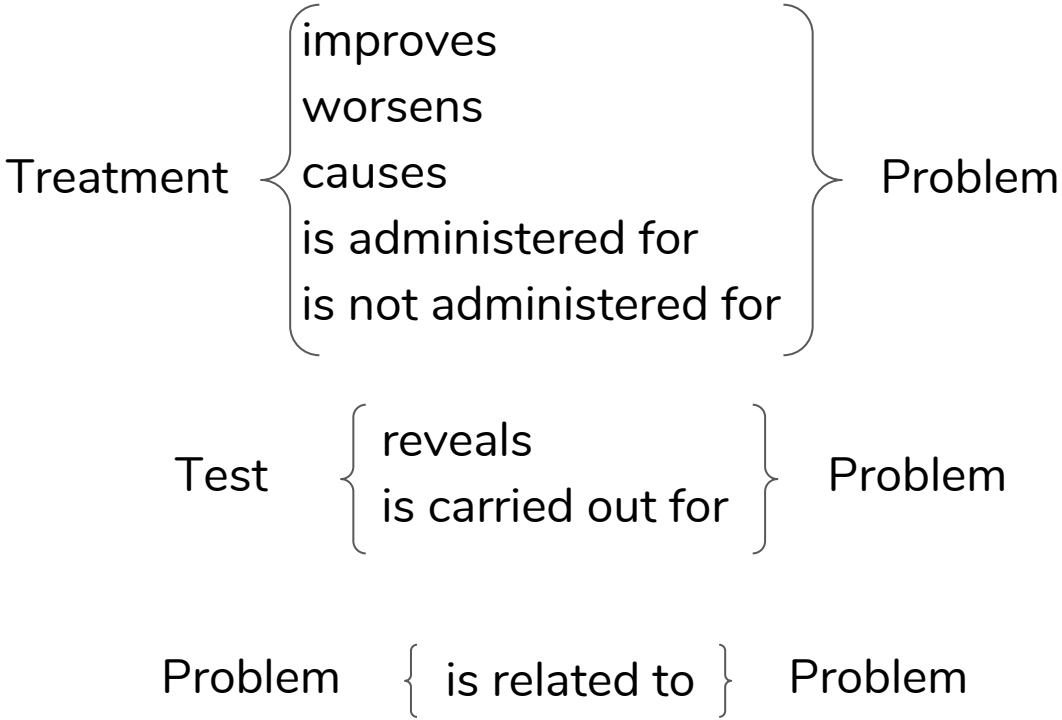
LangModel
MaxFrequent
EmbeddingBased
NeuralReader
HumanNovice
HumanExpert

Human-expert vs. neural-reader performance based on assigned understanding skills



Relation extraction: i2b2-2010 dataset



Relation extraction example

“Acetaminophen 325 mg Tablet Sig : Two (2) Tablet PO Q6H (every 6 hours) as needed for fever or pain”

“Acetaminophen” : ”fever” → Treatment administered for a problem
“Acetaminophen” : ”pain” → Treatment administered for a problem

Relation extractor

Convolutional neural networks with dynamic pooling

- Obtain encodings of segments in a sentence:
  - text before concept_1,
  - text in concept_1,
  - text between concept_1 and concept_2,
  - ...
- Performs well (no manual feature engineering):
  - 0.65 F1 on Treatment-Problem relations
  - 0.79 F1 on Test-Problem relations
  - 0.71 F1 on Problem-Problem relation

Improving the relation extractor

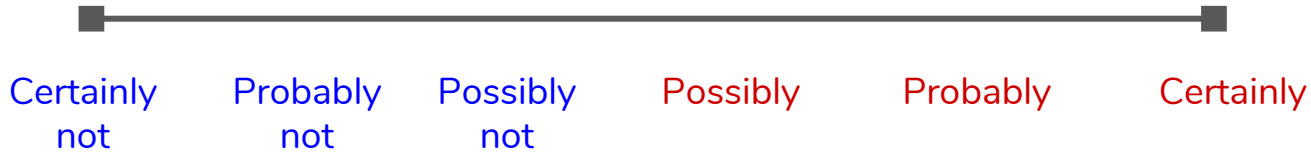
- Observations from a manual analysis:
  - Low recall for many relations
  - Little domain knowledge
  - Certain types of relations are more easily confused
  - Insensitive to negation markers
- Current work:
  - Give more domain knowledge through concept-concept selectional preferences (e.g. drug+problem combinations)
  - Help the classifier focus on relation triggers; include semantic classes for these cues
  - Negation features / module

Modality detection

Plan to develop a stand-alone module:

- Which can be integrated in a relation extractor (degree of certainty)
- Scope can be determined with rules or syntactic parses

See negation and affirmative as two extremes:



Software

https://github.com/clips/accumulate