



Mining for medical relations in research articles

Identification of relations

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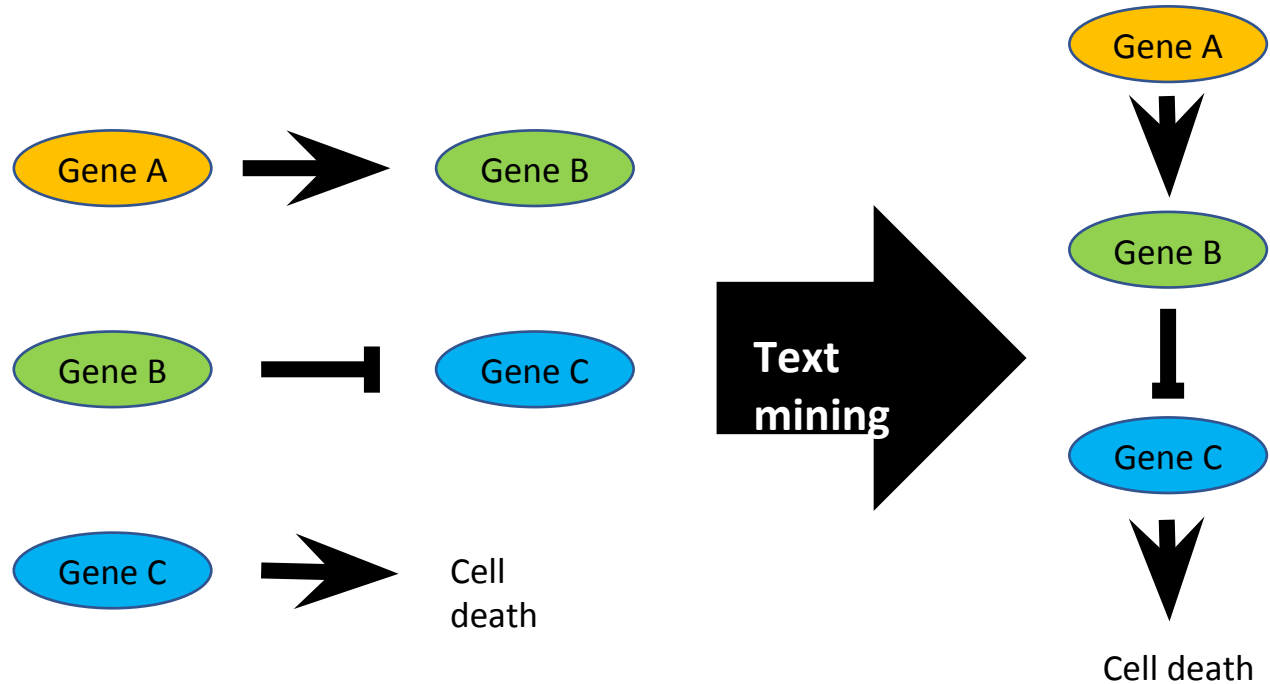


Our role in the BioNLP Project

We process abstracts to extract relations using NLP rules

Anna and Eric find pieces of the puzzle - we connect the pieces

Text mining finds and combines knowledge fragments in medical literature





Relations in biomedical texts

Example abstract marked by Sonja, where colors: **disease**, **protein**, **cell-death term**, **interaction**, **drug**

We are interested in the interactions, when one of the agents is a cell-death related term or protein

Example: **Hsp70** **inhibits** **cell death**

Mechanisms underlying **cancer cell death** caused by **inhibitors** of subcellular **Hsp70** proteins have been elucidated. An **inhibitor of Hsp70**, apoptozole (Az), is mainly translocated into **lysosomes** of **cancer** cells where it **induces** lysosomal membrane permeabilization, thereby **promoting** lysosome-mediated apoptosis. Additionally, Az **impairs** autophagy in **cancer** cells owing to its ability to **disrupt** the lysosomal function. However, the **Az-triphenylphosphonium conjugate, Az-TPP-O3**, **localizes** mainly to **mitochondria** of **cancer** cells where it **inhibits** the **mortalin-Bcl-2** **interaction** and **induces** mitochondrial outer membrane permeabilization, consequently leading to **mitochondria-mediated apoptosis**. Unlike Az, **Az-TPP-O3** **does not have an effect on** autophagy in **cancer** cells. Collectively, the findings indicate that **inhibitors of lysosomal Hsp70** and **mitochondrial mortalin** **enhance** **cancer cell death** via distinctively different mechanisms. Additionally, the findings arising from this effort demonstrate that studies aimed at determining subcellular locations and functions of small-molecule modulators provide a deeper understanding of their modes of action in cells.



Project resources

- ~20 000 000 abstracts from PubMed
- Identified Named Entities from Anna & Eric
- List of interaction keywords from Sonja



Purpose of relation extraction

Apply NLP rules to the abstract data to build an annotated dataset

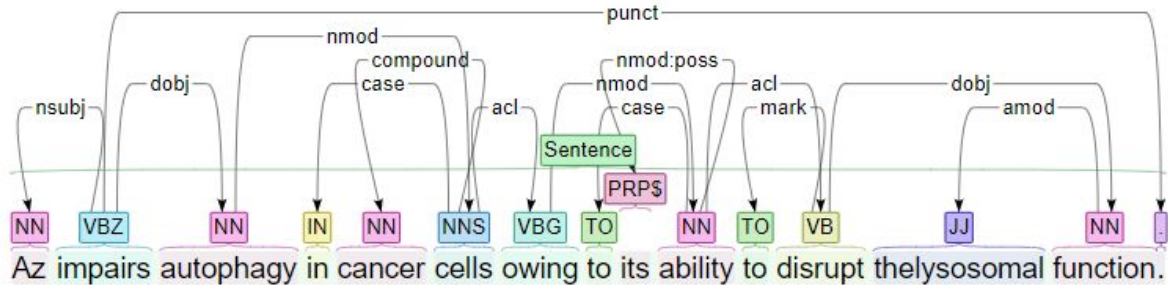
Hannes will train a model based on the dataset

Background - Dependency Graphs

Break down a sentence into dependency relations - extended grammar

Each word has exactly 1 head, the result is a graph that can be traversed

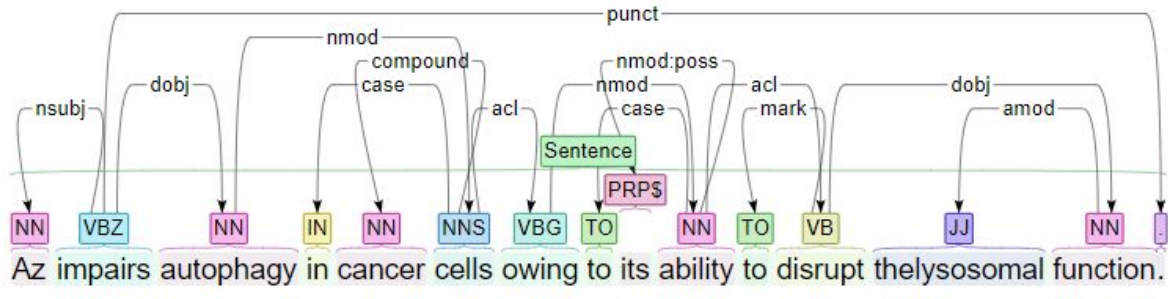
Example:



Background - Noun Chunks

Used noun chunks instead of single words to gain more relevant information

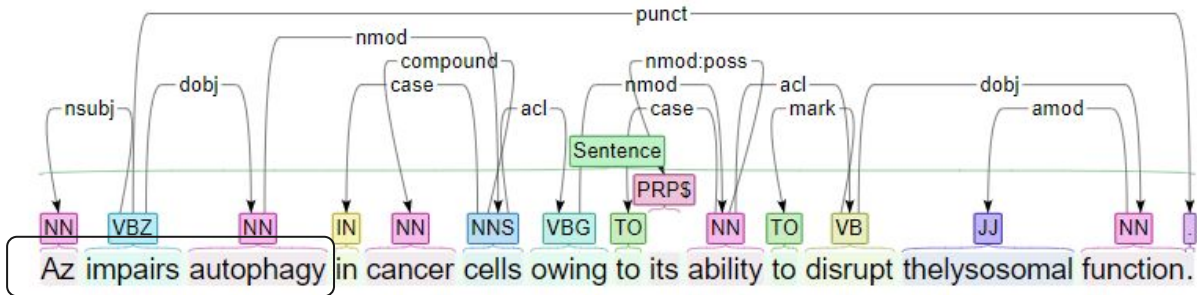
Includes modifying words and compounds along with the main noun (called the root)



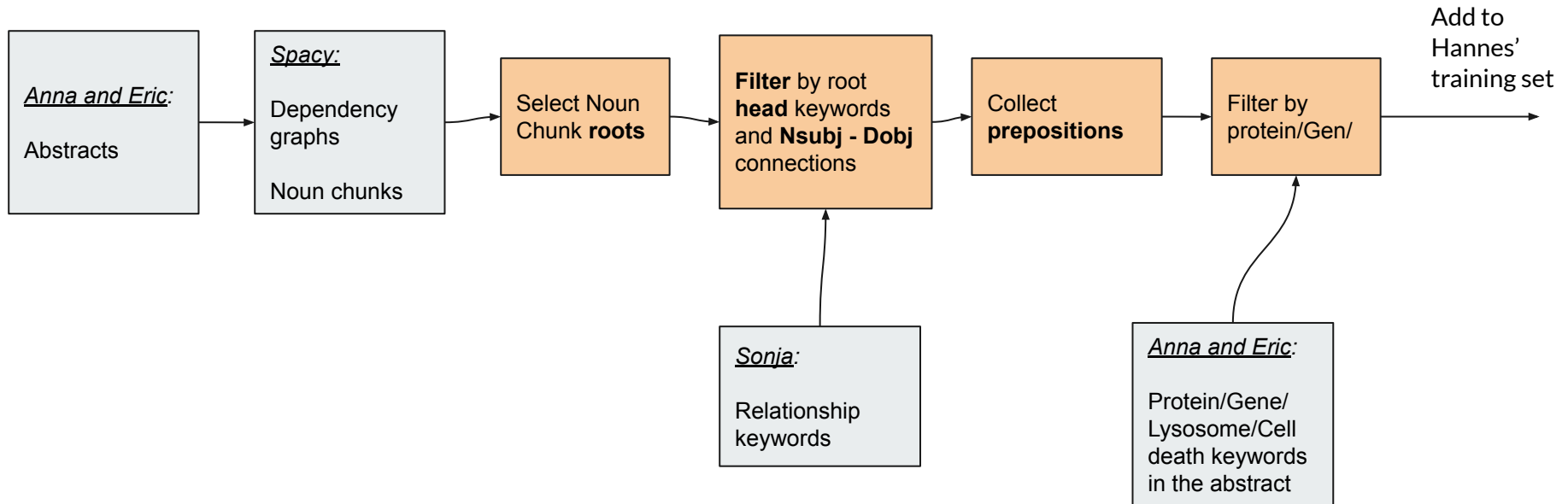
Background - The “A affects B” relation


Focus on the most common relation structure: nominal subject - keyword - direct object

Both the nsubj-chunk and dobj-chunk point to the same interaction



Our algorithm - Overview





Our algorithm - Noun chunks

Mechanisms underlying cancer cell death caused by inhibitors of subcellular Hsp70 proteins have been elucidated. An inhibitor of Hsp70, apoptozole (Az), is mainly translocated into lysosomes of cancer cells where it induces lysosomal membrane permeabilization, thereby promoting lysosome-mediated apoptosis. Additionally, Az impairs autophagy in cancer cells owing to its ability to disrupt the lysosomal function.



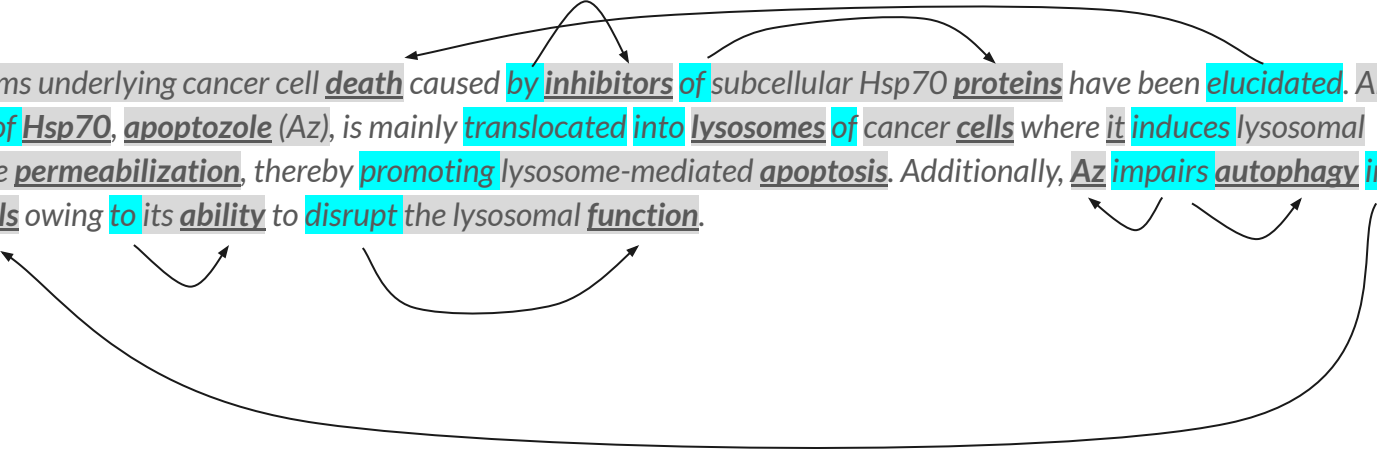
Our algorithm - Noun chunk roots

Mechanisms underlying cancer cell death caused by inhibitors of subcellular Hsp70 proteins have been elucidated. An inhibitor of Hsp70, apoptozole (Az), is mainly translocated into lysosomes of cancer cells where it induces lysosomal membrane permeabilization, thereby promoting lysosome-mediated apoptosis. Additionally, Az impairs autophagy in cancer cells owing to its ability to disrupt the lysosomal function.



Our algorithm - Root heads

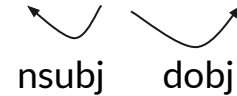
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Our algorithm - Nsubj or Dobj dependency

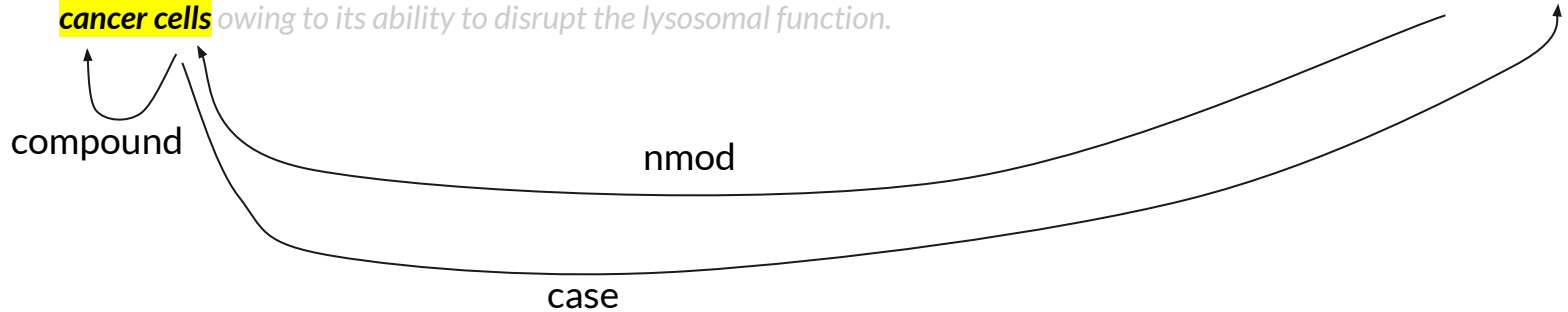
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Our algorithm - Prepositions

Mechanisms underlying cancer cell death caused by inhibitors of subcellular Hsp70 proteins have been elucidated. An inhibitor of Hsp70, apoptozole (Az), is mainly translocated into lysosomes of cancer cells where it induces lysosomal membrane permeabilization, thereby promoting lysosome-mediated apoptosis. Additionally, Az impairs autophagy in cancer cells owing to its ability to disrupt the lysosomal function.





Our algorithm - Filter by relevant terms

Mechanisms underlying cancer cell death caused by inhibitors of subcellular Hsp70 proteins have been elucidated. An inhibitor of Hsp70, apoptozole (Az), is mainly translocated into lysosomes of cancer cells where it induces lysosomal membrane permeabilization, thereby promoting lysosome-mediated apoptosis. Additionally, Az impairs autophagy in cancer cells owing to its ability to disrupt the lysosomal function.



Our algorithm - Finished, pass to Hannes

*Mechanisms underlying cancer cell death caused by inhibitors of subcellular Hsp70 proteins have been elucidated. An inhibitor of Hsp70, apoptozole (Az), is mainly translocated into lysosomes of cancer cells where it induces lysosomal membrane permeabilization, thereby promoting lysosome-mediated apoptosis. Additionally, **Az impairs autophagy in cancer cells** owing to its ability to disrupt the lysosomal function.*



Identified problems

Statements of no relation (“... since **LSD** did not **increase** the **DOPA accumulation**...”)

Coreferences (“A diphosphonate (EHDP) [...] was given to [...] volunteers for 28 days. **It caused** a significant **increase** in mean Pi and P50 in both healthy and diabetic subjects”)

Complex relations, for example passive relations: “We found that **active dopamine (DA)** uptake was **inhibited** by **S1694**.”

Include more interaction keywords



Thank you for watching our presentation!

Any questions?

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