

D20.3 Structure of Arguments in Science: Modelling Kepler's "Astronomia nova"



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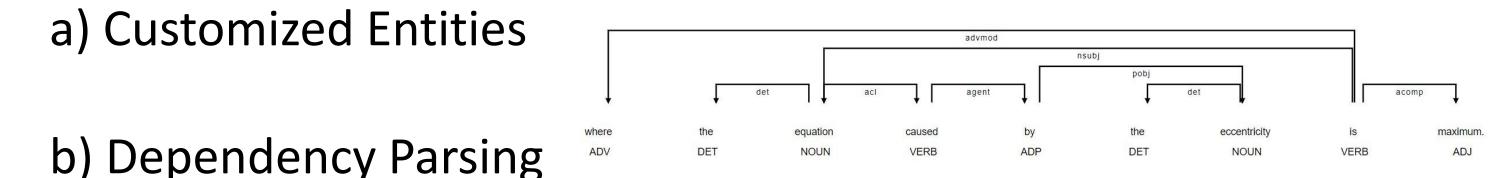
Scientific Publications, text corpora

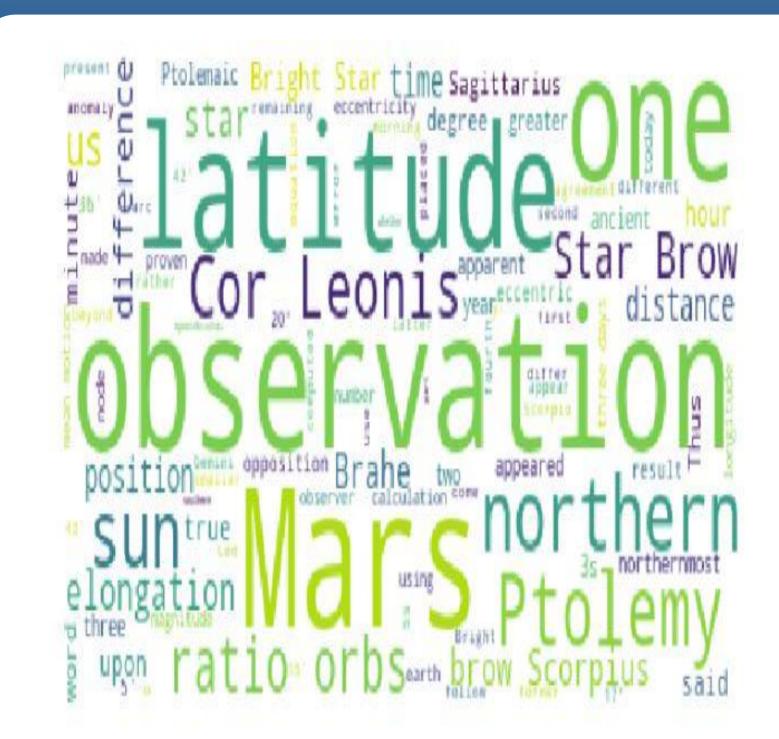
- Kepler's "Astronomia nova" Corpus
 - Revolutionary new theory of planetary motion
 - Purely geometrical epicyclic models by physical interpretations
 - → Aim: Computational model to establish Kepler's arguments!
- Exoplanet Publication Corpus [1]
 - Scientific articles on recent research on exoplanets 1990-2020
 - → Aim: Computational model to extract arguments!
- Corona Virus Publication Corpus
 - The corpus Analysis of growing publications on the COVID-19

Astronomia nova

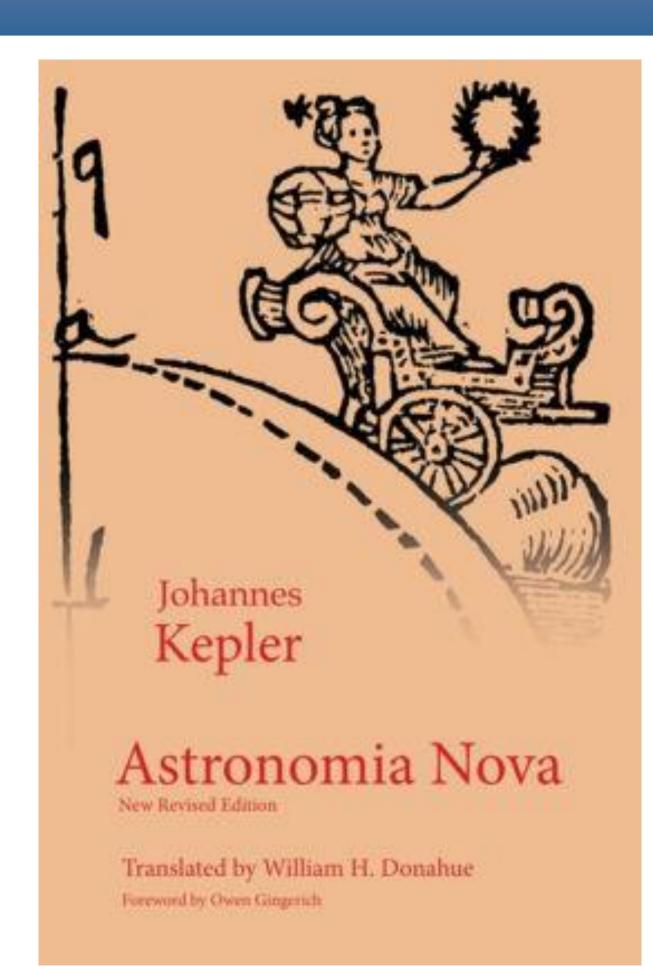
The corpora are represented in structural trees representing their textual division.

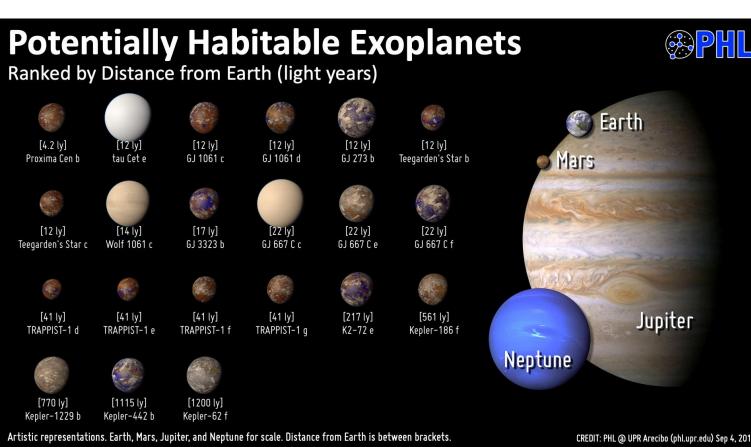
- 1) Parts, chapters, paragraphs, sentences, tables, diagrams
- 2) Sentence Structure with Spacy



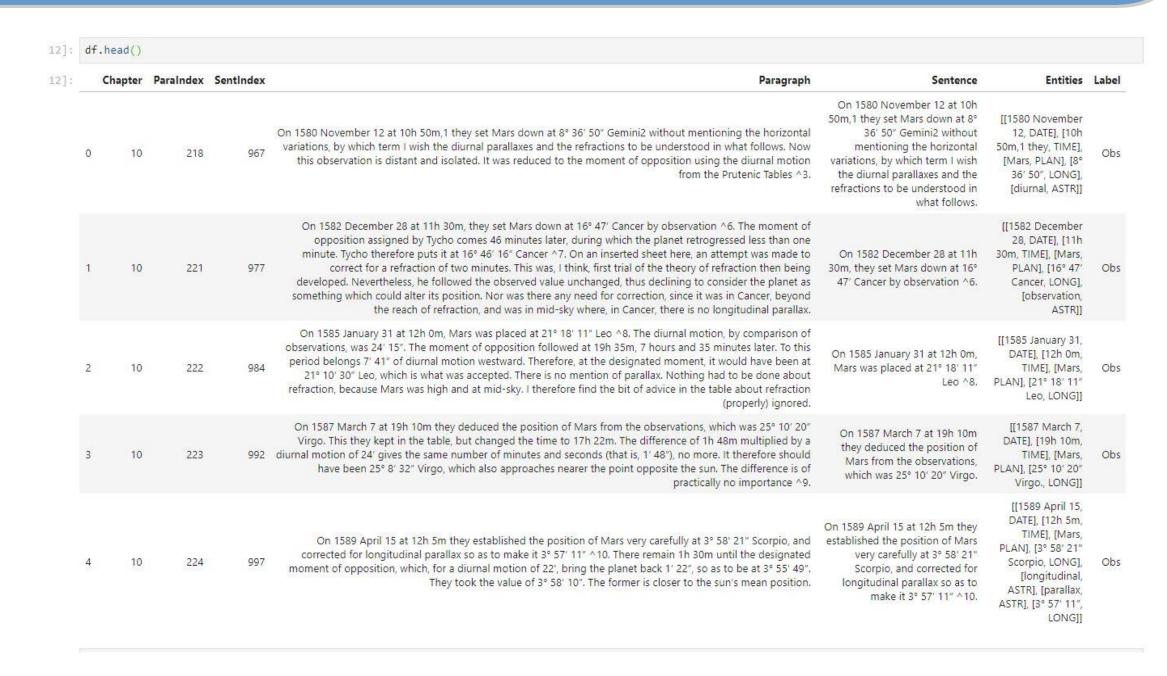


y=0 top features		y=1 top features		y=2 top features		y=3 top features	
Weight?	Feature	Weight?	Feature	Weight?	Feature	Weight?	Feature
+3.054	present	+21.317	compare	+14.381	propose	+13.982	conclude
+2.851	<bias></bias>	+12.742	compared	+9.543	proposed	+1.150	strong
+2.061	model	+2.287	predictions	+1.402	macho	+0.932	fully
+1.711	using	+1.631	spectra	+1.239	microlensing	+0.858	suggests
+1.207	use	+1.444	values	+1.106	theta_	+0.840	likely
+1.190	planet	+1.341	derived	+0.950	blg	+0.813	taken
+1,186	explore	+1.301	obtained	+0.936	better	+0.802	pulsation
+1.023	demonstrate	+1.240	results	+0.925	test	+0.799	presented
6401 more positive		+1.225	trappist	+0.923	coronagraphic	+0.696	nonequilibrium
1810 more negative		+1.144	observed	+0.901	statistical	+0.671	considered
-1.006	optically	+1.060	slow	+0.814	interception	+0.658	necessary
-1.011	coronagraphic	+1.048	<u>L</u>	+0.787	extra	+0.643	explanation
-1.020	events	+1.023	t_	+0.764	collect	+0.641	normal
-1.024	conclusions	+1.016	000	+0.737	experimental	+0.621	114762b
-1.051	derived	+1.007	literature	752 n	nore positive	+0.604	difficult
-1.060	predicted	+1.007	frequencies	7459 more negative		555 more positive	
-1.069	spectra	+0,977	chromospheric	-0.732	different	76561	nore negative
-1.093	values	+0.972	existing	-0.742	spectra	-0.594	results
-1.099	support	+0.967	measurements	-0.746	surface	-0.601	new
-1.107	obtained	+0.967	compares	-0.757	planets	-0.643	apply
-1.110	microlensing	+0.951	spectrum	-0.799	stellar	-0.659	methods
-1.141	macho	1287	nore positive	-0.819	temperature	-0.660	models
-1.143	trappist	6924 n	nore negative	-0.895	evolution	-0.682	based
-1.158	pulsation	-0.944	use	-0.930	light	-0.816	discuss
-1.233	better	-0.954	investigate	-0.935	using	-0.882	use
-1.237	literature	-0.977	composition	-1,001	earth	-0.935	planet
-2.106	predictions	-1.070	using	-1.015	modeling	-0.984	planets
-8.006	proposed	-1.210	conclude	-1.086	compare	-1.118	stellar
-10.899	conclude	-1.216	planet	-1.597	models	-1.245	present
-11.718	compared	-2.089	present	-1.912	present	-1.578	using
-12.273	propose	-2,091	model	-1.917	model	-2.369	model
-19.718	compare	-3.357	<bias></bias>	-3.698	<bias></bias>	-4.037	<bias></bias>

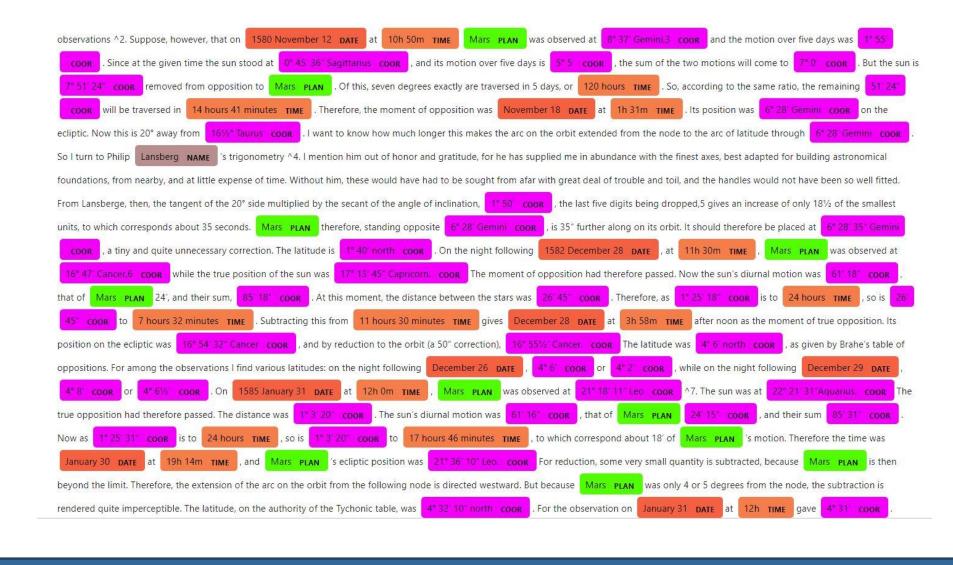




Customized Named Entity Recognition (NER) [2]

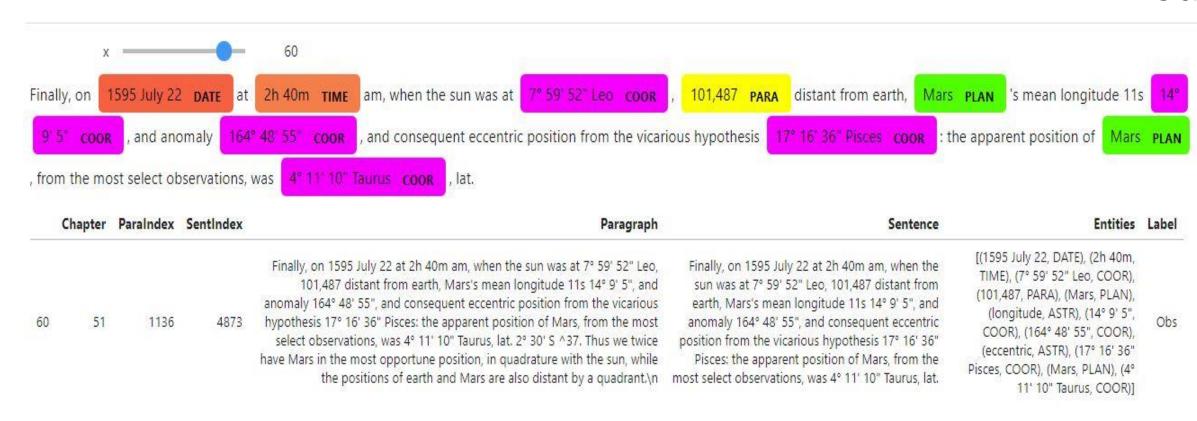


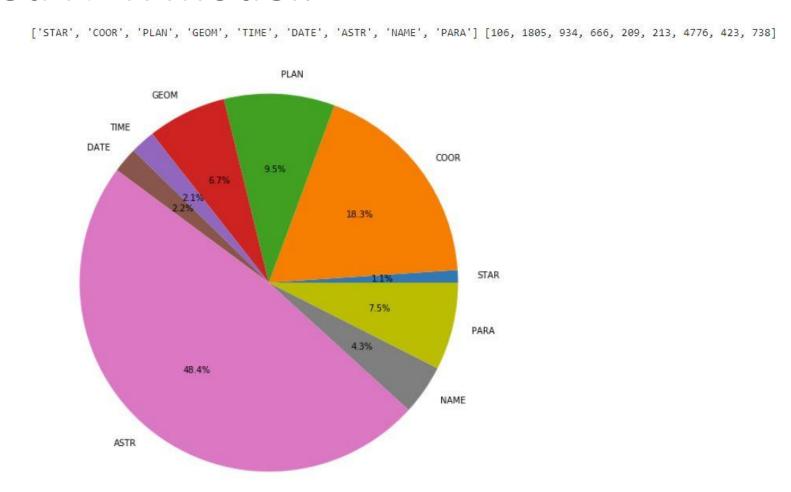
Key Idea. Hybrid approach; Pattern(rule) based & deep learning approach to provide NER model by developing spaCy.



Explicit Observation Extraction [2]

Key Idea. Extract Observations from the corpus by customized NER model.





Future Direction: Semantic Objects

• Tree structure

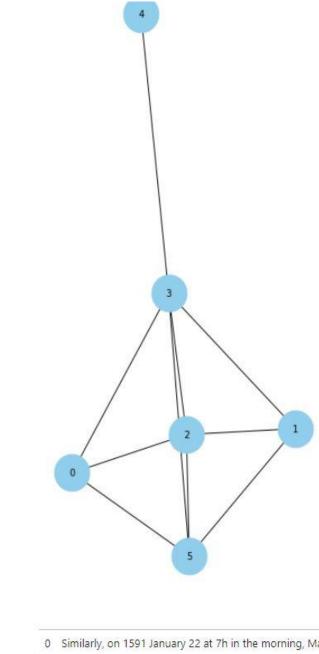
Idea. Integrate sentences using xml format to have semantic annotation for extracted observations as a first use case



• Semantic Relation Extraction Idea. Extract structure of argumentation components using semantic objects



[3] Ribeiro, M. T., Singh, S., & Guestrin, C. (2016, August). "Why should i trust you?" Explaining the predictions of any classifier. In *Proceedings of the 22nd ACM SIGKDD international conference on knowledge discovery and data mining* (pp. 1135-1144).



O Similarly, on 1591 January 22 at 7h in the morning, Mars was 34° 32' 45" from Spica with declination 17° 25' south, at an altitude of 16° ^8.

Therefore, after correction for horizontal variations, the declination was 17° 30'.

Hence, the right ascension was 230° 23' 12", longitude 22° 33' Scorpio, latitude 1° 0' 30" north.

Now this time differs from ours by 1 day 19 hours, and the diurnal motion, from Magini, is 33'.

Therefore, 59' are required for the intervening time.