Towards Czech Answer Type Analysis

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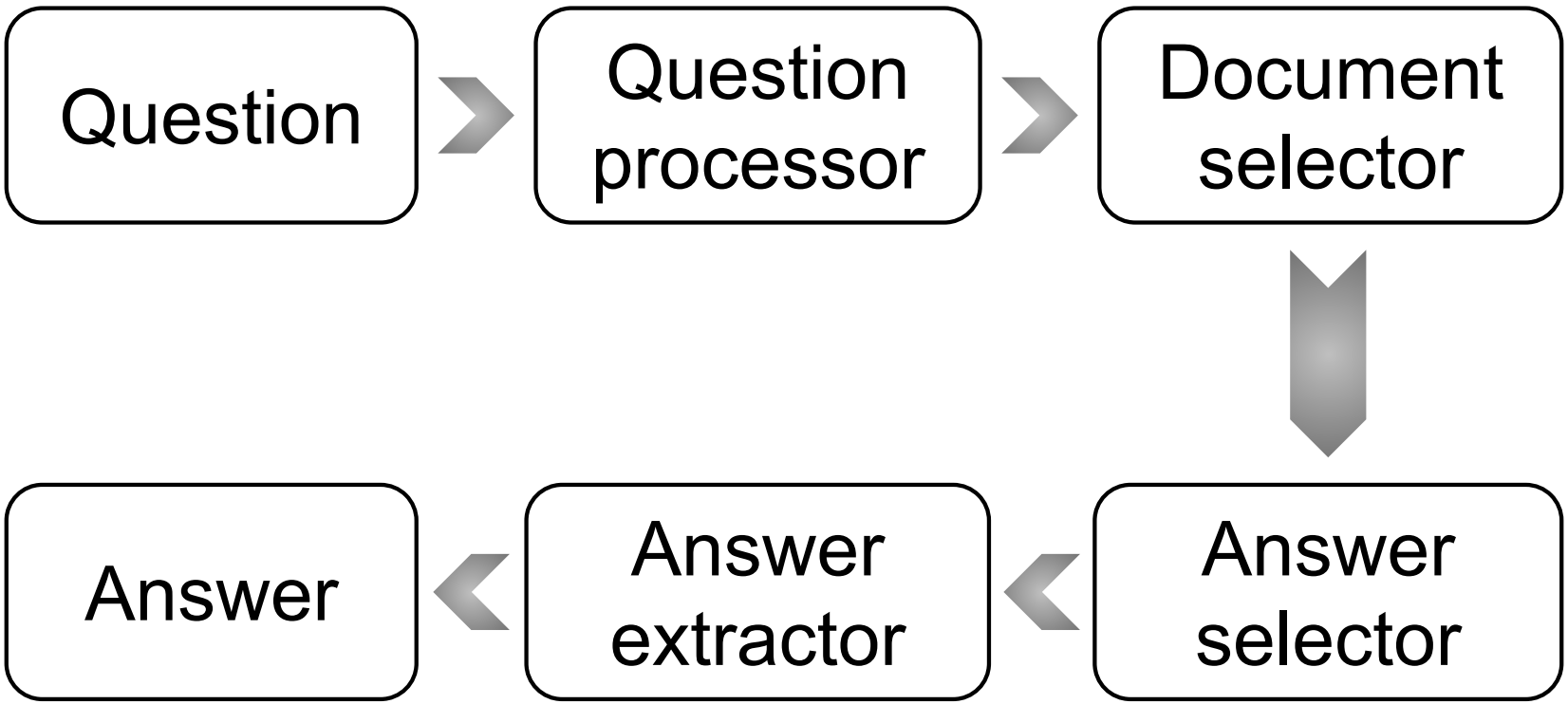
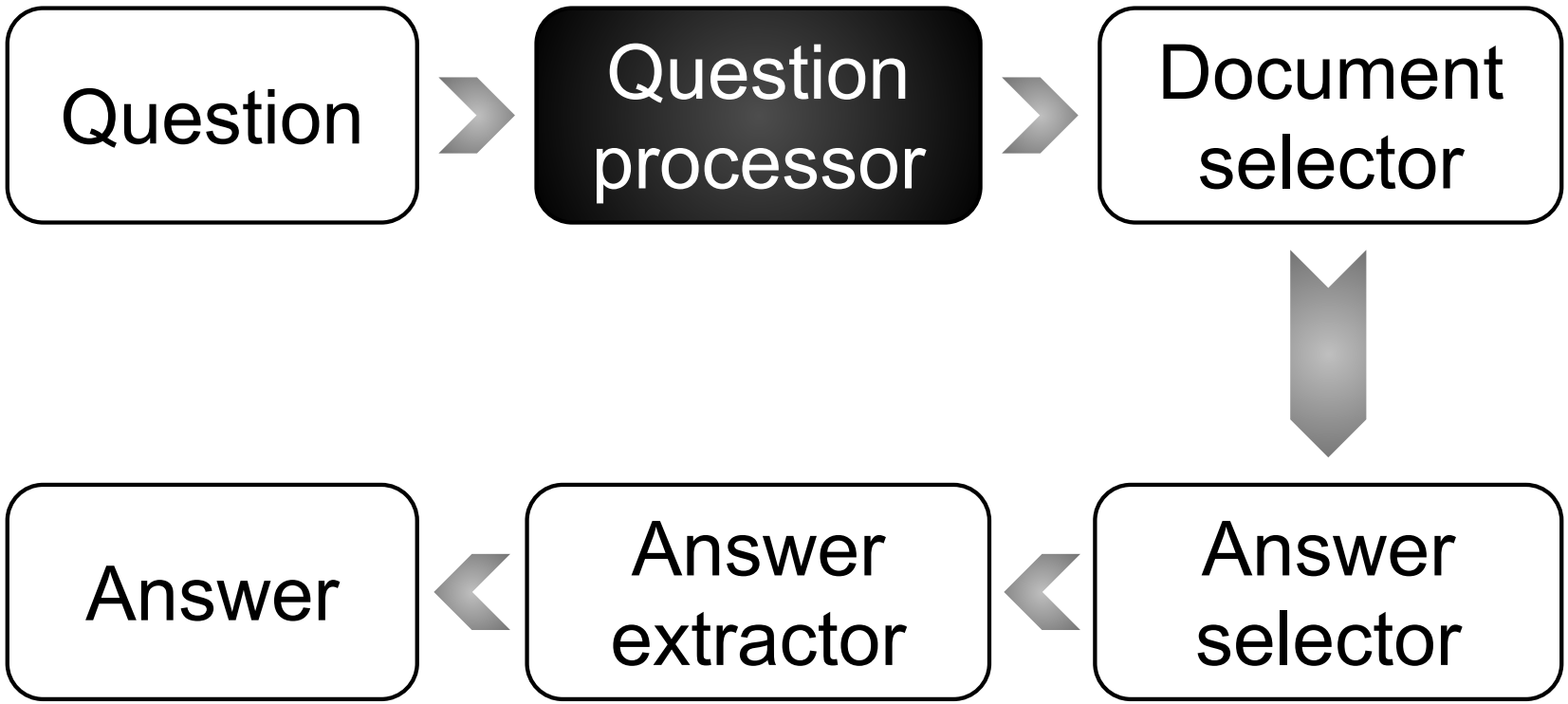
AQA system


Question
Question processor
Document selector
Answer selector
Answer extractor
Answer

AQA system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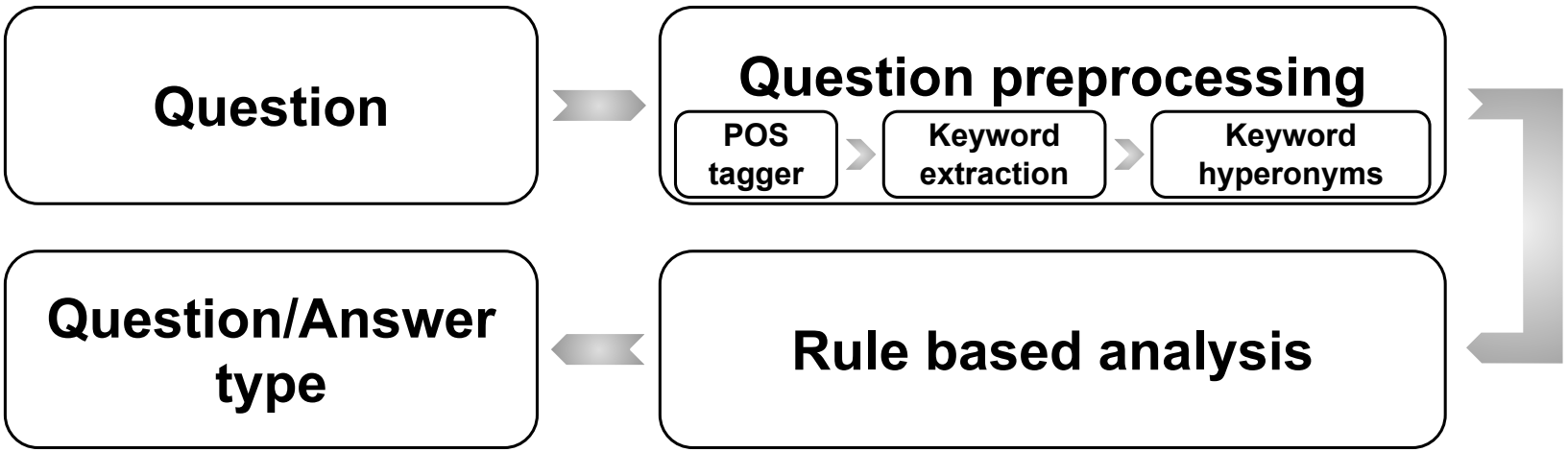
Rule based system

Rule based system



Keyword extraction

- First noun after the relative pronoun *"který"* (which) or *"jaký"* (what), **NOT** part of a relative sentence.
- First noun after the first verb
- First following noun after: *"název"* (title), *"pojem"* (concept), *"termín"* (term), *"typ"* (type), *"část"* (part), or *"větev"* (branch)

Keyword hypernyms

- obtained by means of the Czech Wordnet API
  1. API is queried to find **all possible senses**
  2. API is queried to create a list of hypernyms for **three most common word senses**

Features recognised by rules

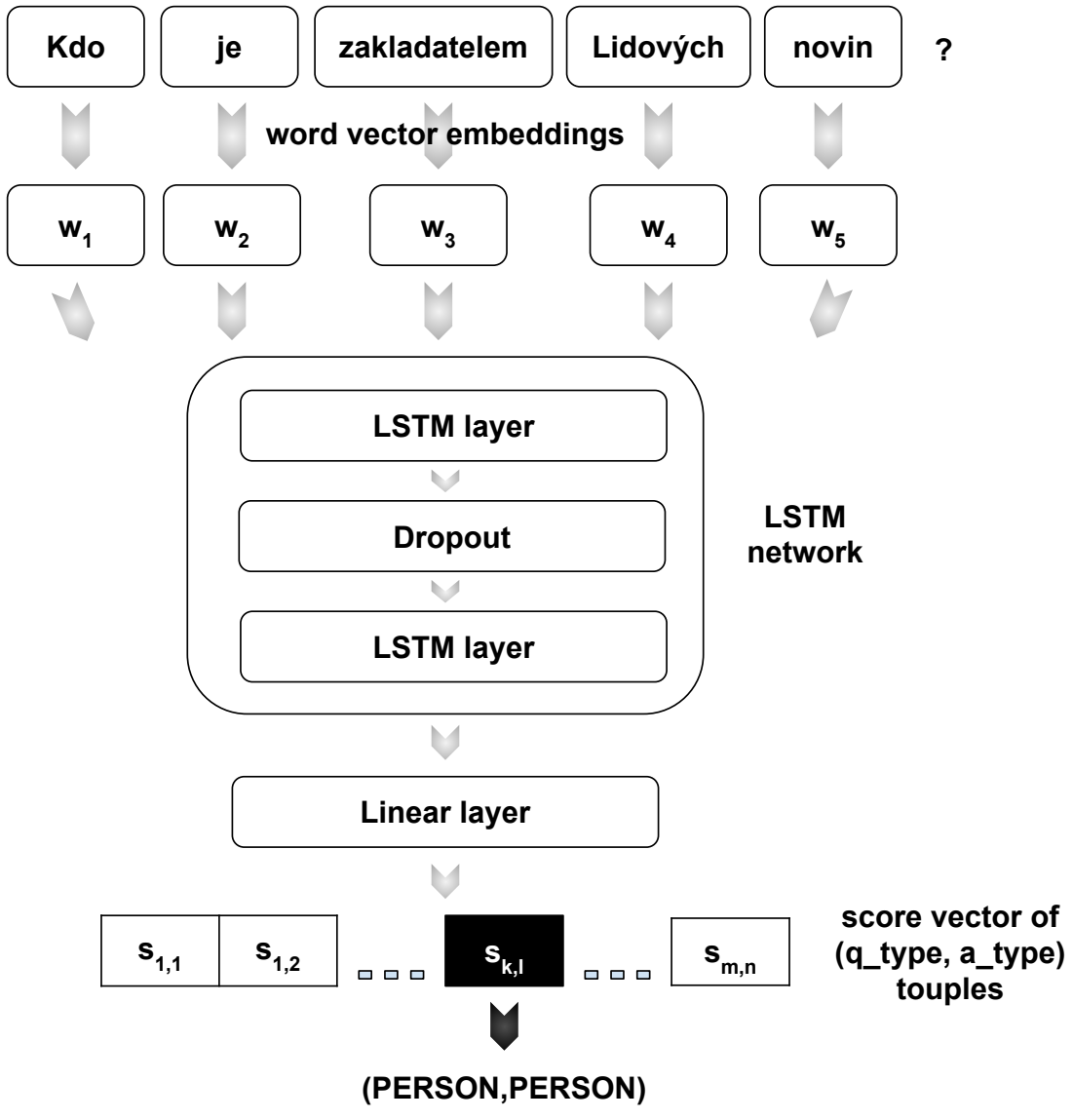
- keyword hypernym match:
  Example: `"<word>" in keyword.hypernym`
- important word recognition:
  Example: `"<word>" == words.lemma_at_index(0)`
  -> the first word in the sentence is the specified word
- question structure match:
  Example: `"k2" in words.tag_at_index(1)`
  -> the second word in the sentence is an adjective

Example

question:	Jak se jmenovala první manželka Miloše Formana? (What was the name of the first wife of Miloš Forman?)
keyword:	manželka (wife)
hypernyms:	[manželka, jednotlivec, osoba, bytost, organismus] (wife, individual, person, being, organism)
rule:	`(PERSON; PERSON) -> "osoba" in keyword.hypernym`

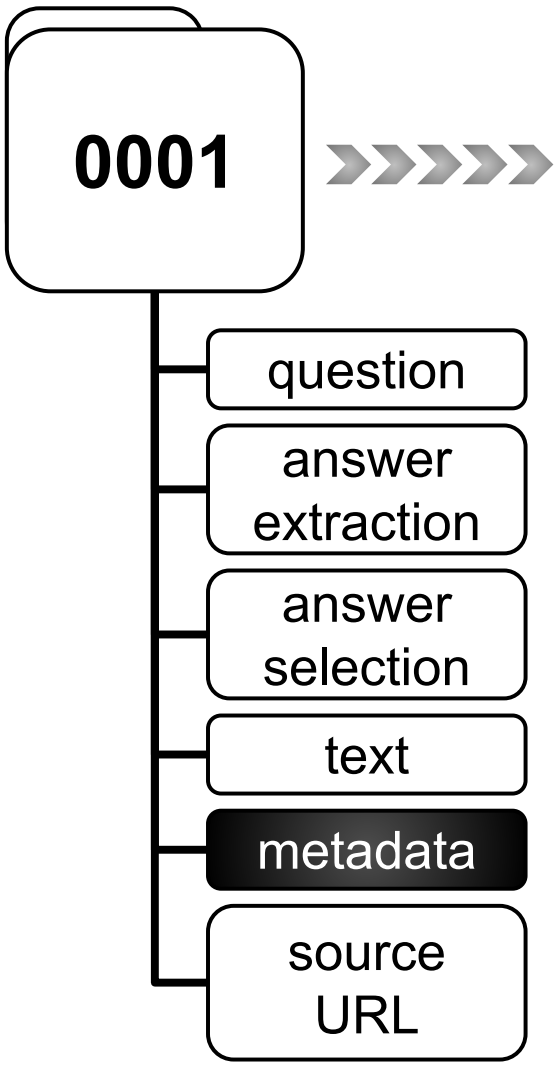
Machine learning based

LSTM architecture



Evaluation

SQAD



- No. of question-answer pairs: **8,566**
- No. of unique documents: **5,417**

SQAD in evaluation

	training	evaluation	testing
Rule based system	4,279	-	4,287
LSTM network	7,011	735	820

Evaluation: rule based

Rule based	precision	recall	F1
question type	88.77%	87.79%	88.28%
answer type	**85.05%**	**84.52%**	**84.78%**
both types	82.43%	82.93%	82.68%

Evaluation: machine learning based

- Model training setup: 40 epochs, batch size of 64, dropout rate of 0.5 and learning rate of 0.001

ML based	precision	recall	F1
question type	91.59%	90.73%	91.16%
answer type	**89.76%**	**89.14%**	**89.45%**
both types	86.15%	87.07%	86.61%

Evaluation: machine learning based

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Question type confusion matrix: rule based

	expected									
pred	AB	APHR	CLS	D/T	ENT	LOC	NUM	OTH	PER	VPHR
AB	37	1	1	0	19	3	1	0	0	0
APHR	1	52	4	0	49	6	6	0	4	0
CLS	1	0	35	0	14	4	0	0	5	0
D/T	0	0	1	916	16	0	2	0	1	1
ENT	0	44	71	3	685	41	13	2	40	8
LOC	0	6	1	0	22	695	3	0	3	1
NUM	1	4	1	4	8	0	422	0	0	0
OTH	0	1	3	2	25	7	7	5	3	6
PER	0	8	3	0	33	6	2	0	455	0
VPHR	0	0	0	0	0	0	0	0	0	454

Answer type confusion matrix: rule based

	expected									
pred	AB	D/T	ENT	LOC	NUM	ORG	OTH	PER	DNT	Y/N
AB	37	0	9	3	1	1	9	2	0	0
D/T	0	915	7	0	2	1	8	1	2	1
ENT	0	2	405	32	14	19	191	40	10	5
LOC	0	0	7	693	3	9	15	3	0	1
NUM	1	3	3	0	423	0	9	0	1	0
ORG	1	0	30	5	0	61	24	6	0	0
OTH	2	2	46	16	14	10	138	19	3	7
PER	0	0	12	7	2	13	18	452	3	0
DNT	0	0	1	1	1	1	3	0	38	0
Y/N	0	0	0	0	0	0	0	0	0	454

Question type confusion matrix: machine learning based

	expected									
pred	AB	APHR	CLS	D/T	ENT	LOC	NUM	OTH	PER	VPHR
AB	7	0	0	0	2	0	0	0	0	0
APHR	0	12	0	0	9	2	0	0	1	0
CLS	0	0	9	0	12	0	0	0	3	0
D/T	0	0	0	175	0	0	0	0	0	0
ENT	0	5	6	0	129	3	1	0	9	1
LOC	0	1	0	0	7	141	0	0	1	0
NUM	1	1	0	1	0	0	87	0	0	0
OTH	0	0	0	0	1	0	0	0	0	1
PER	0	0	0	0	6	0	0	0	95	0
VPHR.	0	0	0	0	1	0	0	1	0	89

Answer type confusion matrix: machine learning based

	expected									
pred	AB	D/T	ENT	LOC	NUM	ORG	OTH	PER	DNT	Y/N
AB	7	0	0	0	0	1	1	0	0	0
D/T	0	175	0	0	0	0	0	0	0	0
ENT	0	1	72	4	0	2	13	3	1	0
LOC	0	0	2	140	0	2	2	1	0	0
NUM	1	1	0	0	87	0	1	0	0	0
ORG	0	0	1	0	0	12	1	3	0	0
OTH	0	3	20	2	1	0	44	7	2	2
PER	0	0	3	0	0	2	2	96	0	0
DNT.	0	0	2	0	0	0	1	0	9	0
Y/N	0	0	0	0	0	0	1	0	0	89

Future work

Original implementation of answer type analysis in AQA system

Example

(AGENT, LANGUAGE, PLACE, WORK): [ktery, jaky, prepktery, ...]
(AGENT, PLACE, NEUTRAL): [kdo, koho, komu, kym, ...]
(AGENT, LANGUAGE, WORK, NEUTRAL): [cim]
(AGENT, PLACE): [kde, kam, sestranyceho, zakoho]
PLACE: [kudy]
T: [kdy, kolik, zkolika, dokdy, dokolika, ...]
NEUTRAL: [proc, zaceho, naproticemu]
DEATH/BIRTH: [kdebirth, kdybirth, kdydeath, kdedeath]

- recognition through SET (Matej Pavla 2014)

Future work

- connect developed tools into AQA pipeline
- experimenting with its architecture
- experiment with hyperparameters settings

Thank you for your attention