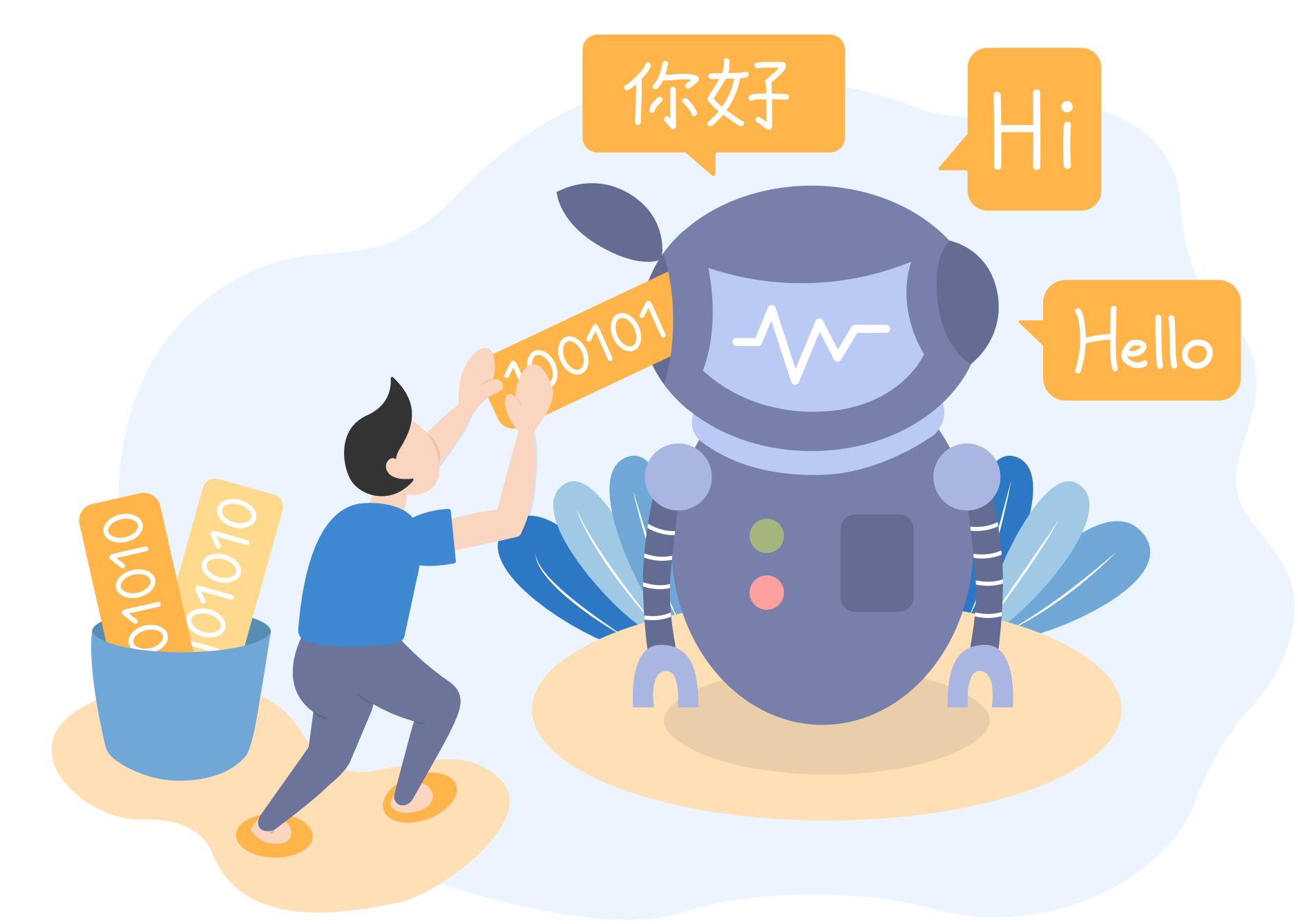# How multitasking benefits QA Retrieval

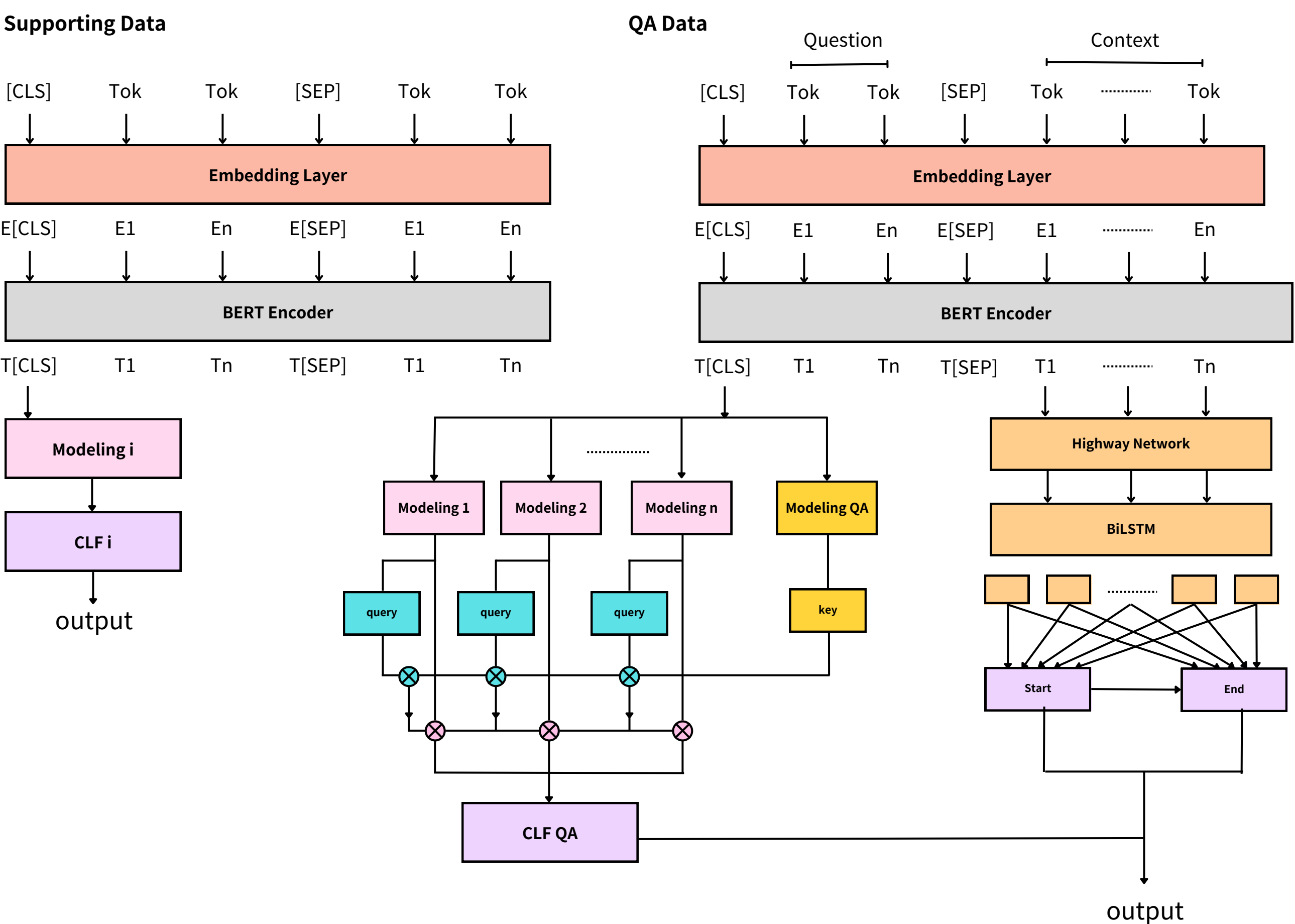*Dataset : SQuAD2.0, MNLI, CoLA, QNLI, RTE*

OUR GOALS

Increase the performance of classification in Squad 2.0

We tried some multitasking mechanism to help the model get more weight on the [CLS] token, also make sure that answerable questions work properly.

MODEL STRUCTURE

For supporting Data

Shared layer: Embedding, BERT Encoder
Specific layer: Modeling, Classifier
Input format : [CLS] sentence1 [SEP] sentence2

Using modeling QA to get the key, then do the single-head self-attention to the N modeling results. Ultimately, use the CLF QA to determine if the context has the answer.

Linear(Concatenate the last 4 hidden states in BERT Encoder)
+
BERT Pooler(T[CLS])

For QA retrieval Data

Shared layer: Embedding, BERT Encoder, Supporting Data Modeling
Specific layer: other
Input format: [CLS] question [SEP] context

Extract the representation of context T_i, fed into the Highway to refine the BERT-embedded representation and pass through the LSTM layer to get the new T_i.

Highway network :

$$x_p = ReLU(W_P T_i + b_P)$$
$$x_{gate} = \sigma(W_{gate} T_i + b_{gate})$$
$$x_{highway} = x_{gate} \oslash x_P + (1 - x_{gate}) \oslash T_i$$

BiLSTM :

$$\{b_1, b_2, \ldots \ldots, b_L\} = BiLSTM(\{x_1, x_2, \ldots \ldots x_L\})$$

ACC & LOSS & F1 SCORE

Result of 70k SQuAD2.0

	Has answer F1 score	No answer F1 score	Has answer accuracy	No answer accuracy
Vanilla	0.6990	0.7695	0.8712	0.7610
MTL	**0.7031**	**0.7958**	**0.8818**	**0.7897**

Result of 7k SQuAD2.0

	Has answer F1 score	No answer F1 score	Has answer accuracy	No answer accuracy	No answer recall
Vanilla	0.5502	**0.9772**	0.8361	**0.9715**	0.5581
MTL	**0.6980**	0.7672	**0.9229**	0.7550	**0.6760**

EXAMPLE FOR QA

Multi-hop question :

Sam walks into the kitchen.
Sam picks up an apple.
Sam walks into the bedroom.
Sam drops the apple.

Q : Where's the apple ?

MTL : bedroom (has answer probabiliy: 0.9120)

Vanilla : sam picks up an apple. sam walks into the bedroom (has answer probabiliy: 0.7799)

The punctuation effect :

After the 1980s, the use of the "Canadian Armed Forces" name gave way to "Canadian Forces";[citation needed] The "Canadian Armed Forces" name returned in 2013

Q : What is the old name of the Canadian Forces?

MTL : NO ANSWER (has answer probabiliy: 0.4855)

Vanilla : NO ANSWER (has answer probabiliy: 0.2459)

After the 1980s, the use of the "Canadian Armed Forces" name gave way to "Canadian Forces".[citation needed] The "Canadian Armed Forces" name returned in 2013

Q : What is the old name of the Canadian Forces?

MTL : "canadian armed forces"
(has answer probabiliy: 0.5331)

Vanilla : NO ANSWER (has answer probabiliy: 0.2716)

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