
FLIGHT 123 YOU SHOULD STOP DESCEND FLIGHT LEVEL ONE FOUR ZERO
ROGER STOP DESCEND FLIGHT LEVEL ONE FOUR ZERO
PILOT
ATC

Fig. 1

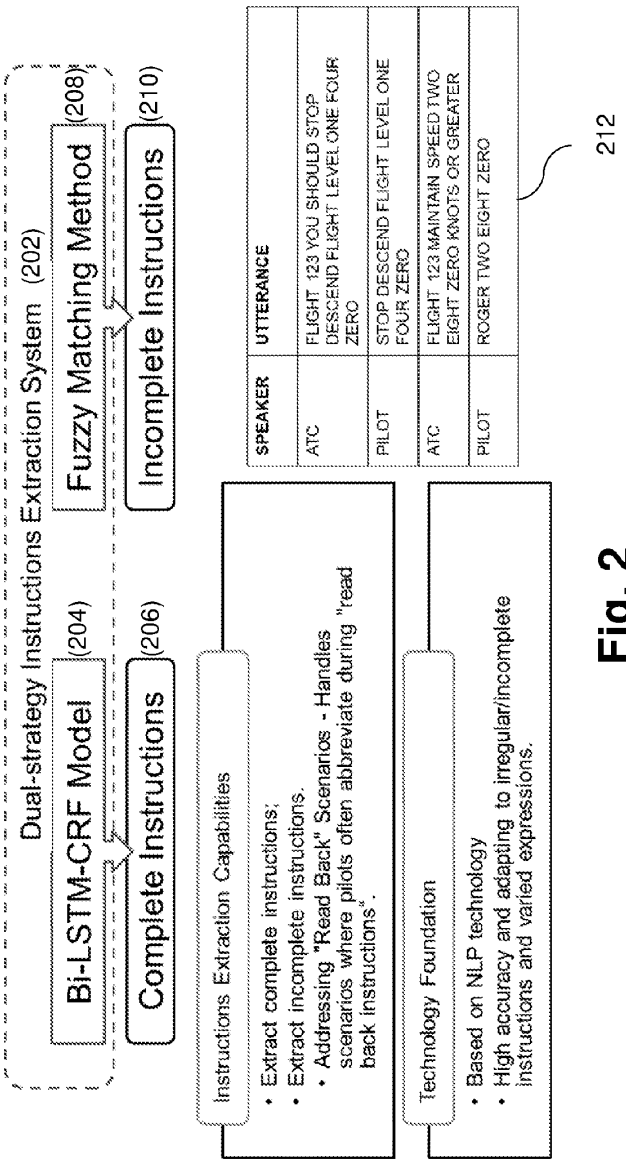

Dual-strategy Instructions Extraction System (202)
Bi-LSTM-CRF Model (204)
Complete Instructions (206)
Fuzzy Matching Method (208)
Incomplete Instructions (210)
Instructions Extraction Capabilities
• Extract complete instructions;
• Extract incomplete instructions.
• Addressing "Read Back" Scenarios - Handles scenarios where pilots often abbreviate during "read back instructions".
Technology Foundation
• Based on NLP technology
• High accuracy and adapting to irregular/incomplete instructions and varied expressions.
SPEAKER
UTTERANCE
ATC
FLIGHT 123 YOU SHOULD STOP DESCEND FLIGHT LEVEL ONE FOUR ZERO
PILOT
STOP DESCEND FLIGHT LEVEL ONE FOUR ZERO
ATC
FLIGHT 123 MAINTAIN SPEED TWO EIGHT ZERO KNOTS OR GREATER
PILOT
ROGER TWO EIGHT ZERO
212

Fig. 2

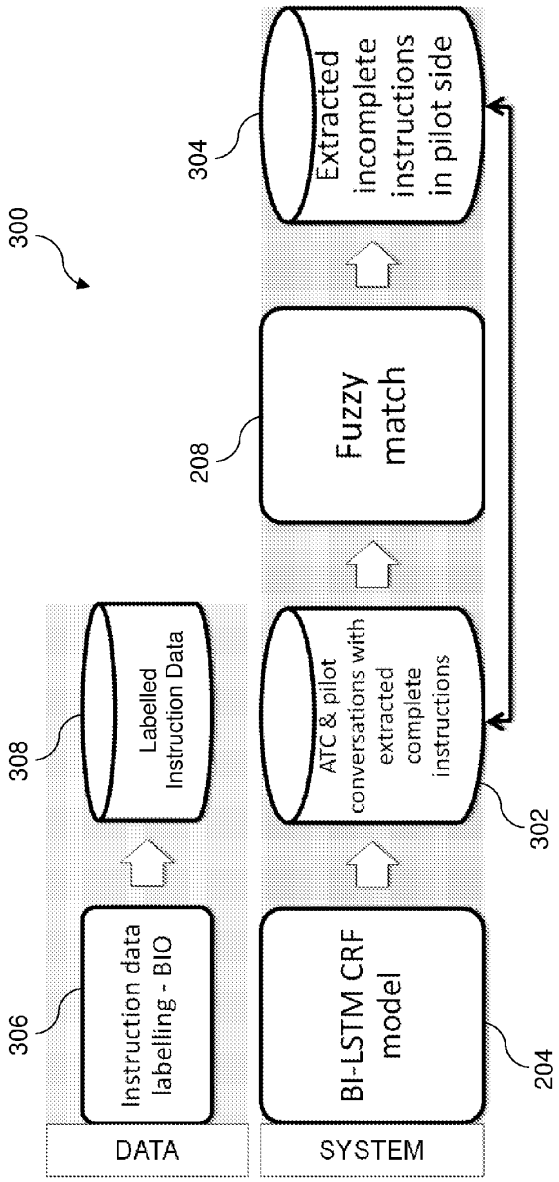

300
304
Extracted incomplete instructions in pilot side
208
Fuzzy match
308
Labelled Instruction Data
ATC & pilot conversations with extracted complete instructions
302
306
Instruction data labelling - BIO
BI-LSTM CRF model
204
DATA
SYSTEM

Fig. 3

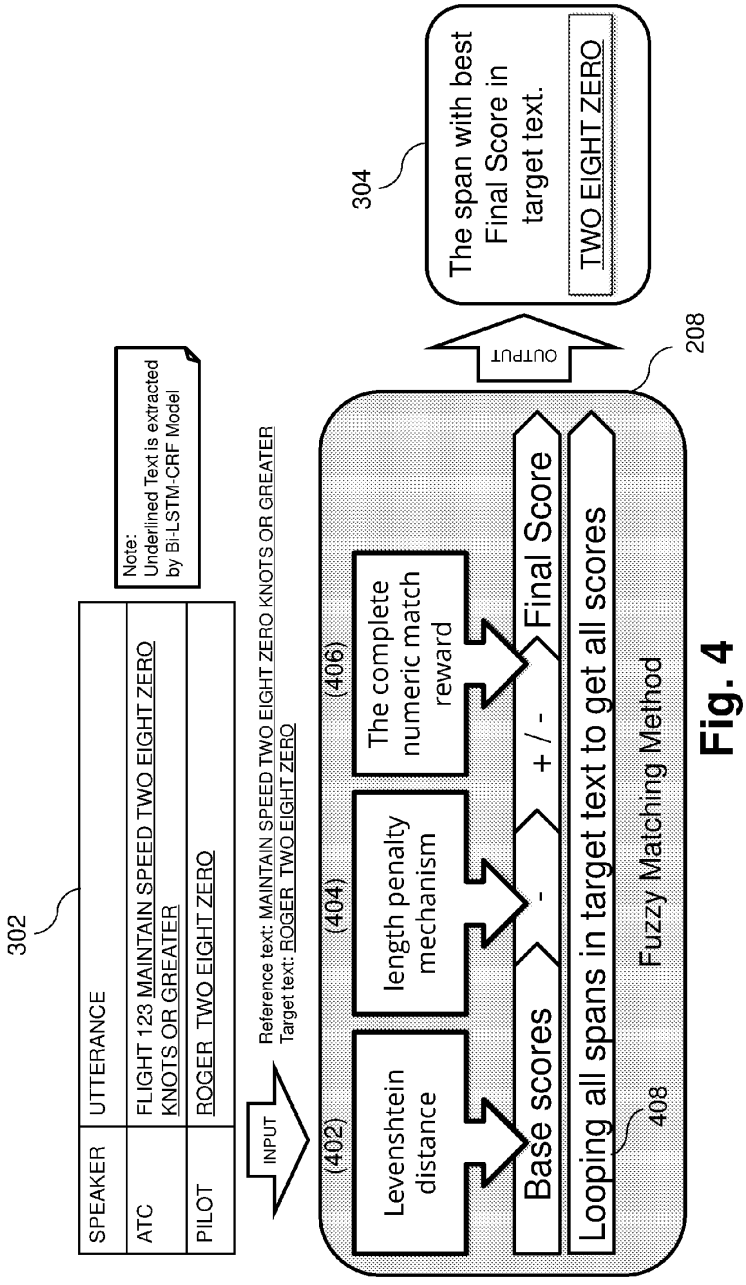
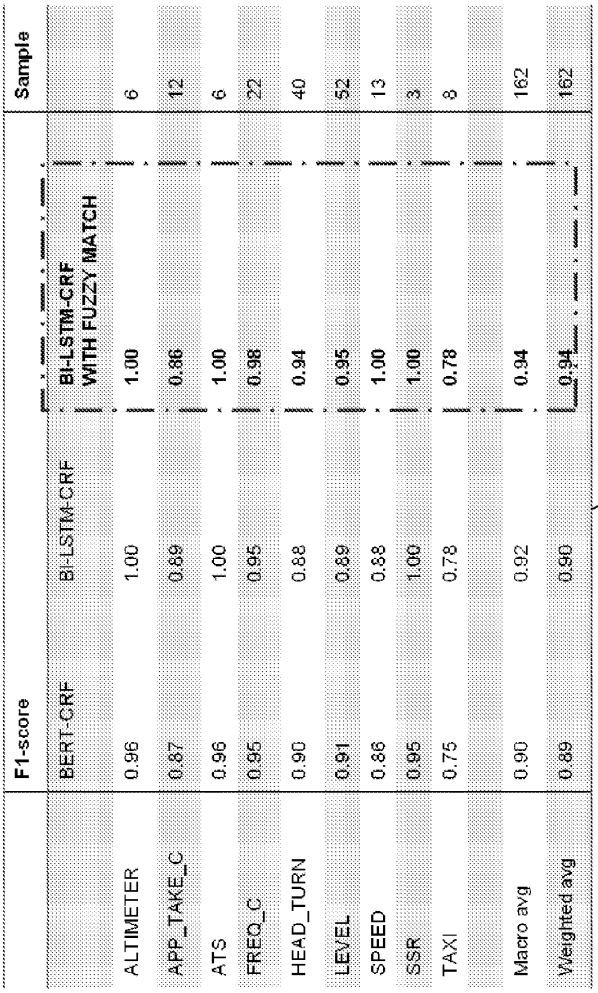

302
SPEAKER
UTTERANCE
ATC
FLIGHT 123 MAINTAIN SPEED TWO EIGHT ZERO KNOTS OR GREATER
PILOT
ROGER TWO EIGHT ZERO
Note:
Underlined Text is extracted by Bi-LSTM-CRF Model
INPUT
Reference text: MAINTAIN SPEED TWO EIGHT ZERO KNOTS OR GREATER
Target text: ROGER TWO EIGHT ZERO
(402)
Levenshtein distance
(404)
length penalty mechanism
(406)
The complete numeric match reward
Base scores
-
+ / -
Final Score
Looping all spans in target text to get all scores
408
Fuzzy Matching Method
208
OUTPUT
304
The span with best Final Score in target text.
TWO EIGHT ZERO

Fig. 4



	F1-score			Sample
	BERT-CRF	BI-LSTM-CRF	BI-LSTM-CRF WITH FUZZY MATCH	
ALTIMETER	0.96	1.00	1.00	6
APP_TAKE_C	0.87	0.89	0.86	12
ATS	0.96	1.00	1.00	6
FREQ_C	0.95	0.95	0.98	22
HEAD_TURN	0.90	0.88	0.94	40
LEVEL	0.91	0.89	0.95	52
SPEED	0.86	0.88	1.00	13
SSR	0.95	1.00	1.00	3
TAXI	0.75	0.78	0.78	8
Macro avg	0.90	0.92	0.94	162
Weighted avg	0.89	0.90	0.94	162

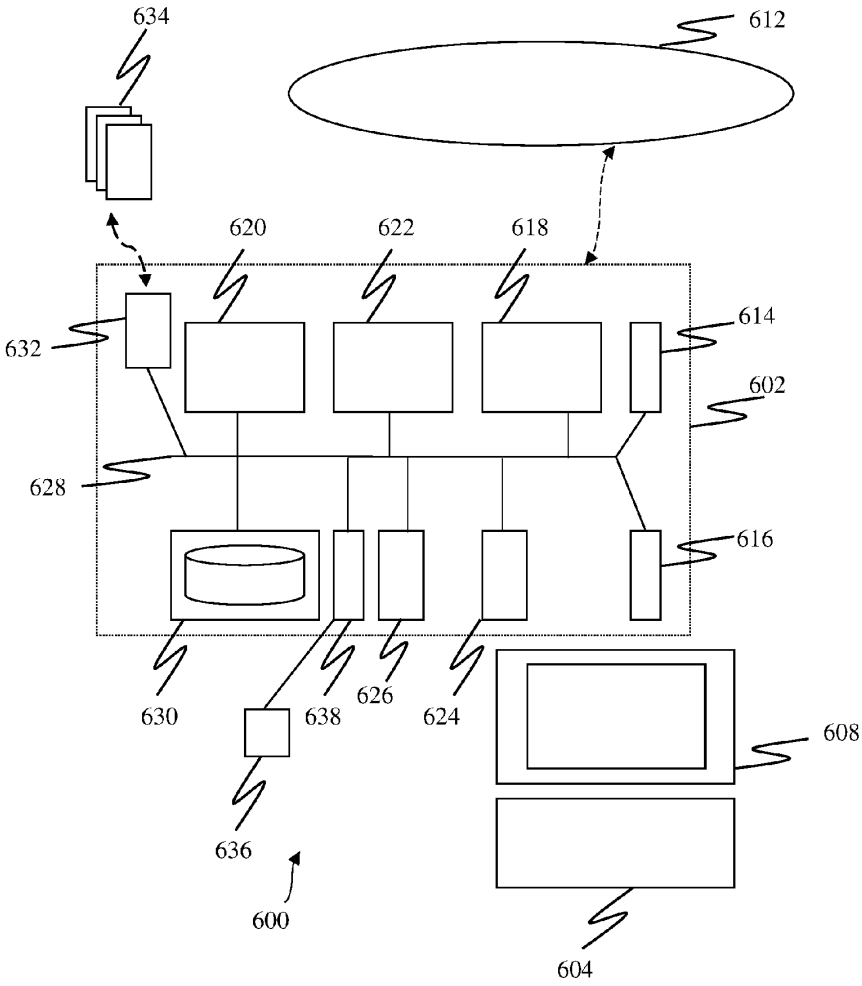
504

	Sample
ALTIMETER	317
APP_TAKE_C	429
ATS	439
FREQ_C	527
HEAD_TURN	784
LEVEL	2132
SPEED	495
SSR	57
TAXI	478
Total utterances	7928

502

Fig. 5

Fig. 6


634
612
620
622
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