DTCC
2017第八届中国数据库技术大会
DATABASE TECHNOLOGY CONFERENCE CHINA 2017

Dialogue System in Practice
Suning Bot Platform

Li Wei
Artificial Intelligence Lab, Suning Research

Agenda

- Overview of Dialogue System
- Natural Language Understanding (NLU)
- Dialogue Management (DM)
- Natural Language Generation (NLG)
- AI + HI = MI Architecture
- Demo

Information Retrieval Trend

Library Search, 1970

Web Search, 1990

Dialogue System, 2015

Dialogue Structure

- Local Structure
  - Utterance organized in turns
  - Coherence between turns or utterances
  - Single-turn and multi-turn
- Global Structure
  - Opening
    - Greetings
  - Body
    - Topics
  - Closing
    - farewells

Dialogue System

- Definition
  - A computer system intended to converse with a human, with a coherent structure
- Dialogue Characteristics
  - Exchanging ideas
  - Requesting information
  - Sustaining relationships

Dialogue System Types

- Chat Bot
  - Free chat on specific or open topics
  - xiaoIce, Microsoft
  - Duer, Baidu
- Task Bot
  - Task completion on special domains
  - Cortana, Microsoft
  - Siri, Apple

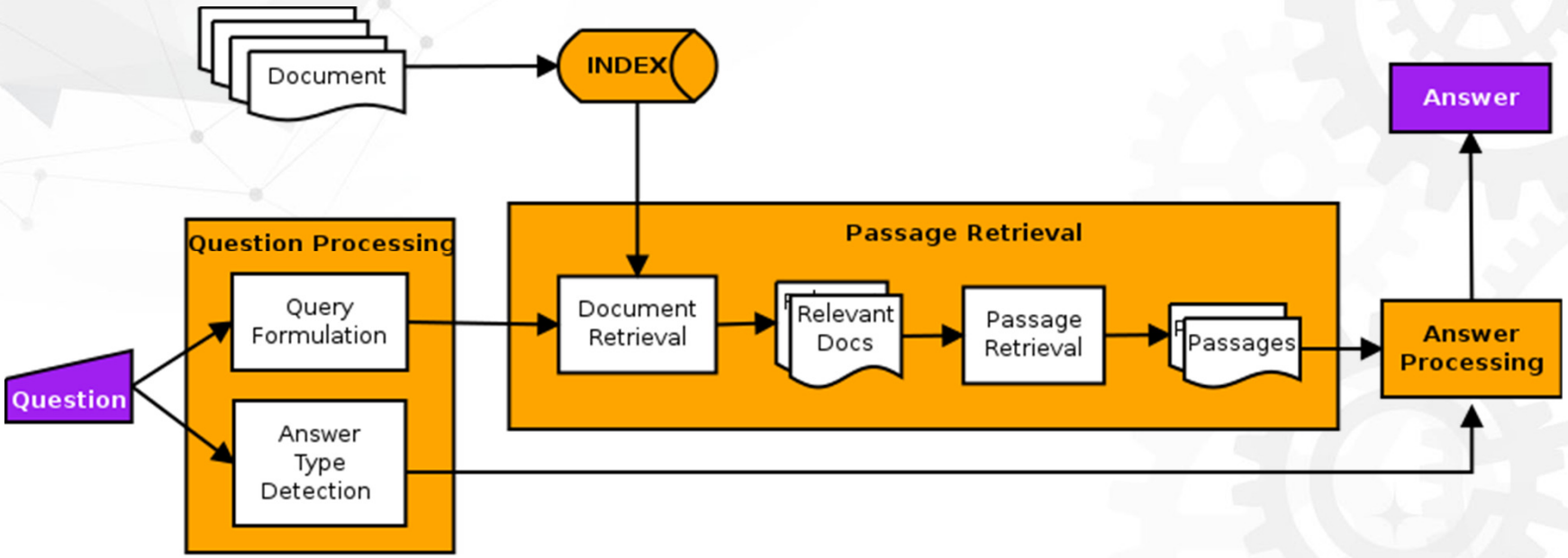
Dialogue System Models

- Data-driven models
  - Large-scale corpus is required
  - Retrieval-based methods
  - Generation-based methods
- Interaction-driven models
  - Online interaction between users and agents
  - Reinforcement learning-based approaches

Question Answering Overview

- Definition
  - Automatically answer a user's question by machine
- Types of QA
  - Types of questions
    - Factoid, who is the wife of Obama
    - Opinion, what is your point to air pollution
    - Yes-no, are you happy?
    - Comparison, what are the differences between mac and windows?
  - Types of content
    - Textual QA
    - Visual QA
- Key technology behind Dialogue System

Question Answering Architecture



Difference between QA and IR

- Input
  - QA, utterance, free text
  - IR, query word
- Output
  - QA, answers
  - IR, documents
- Key technology
  - QA, provide answers for given questions
  - IR, find documents related to queries

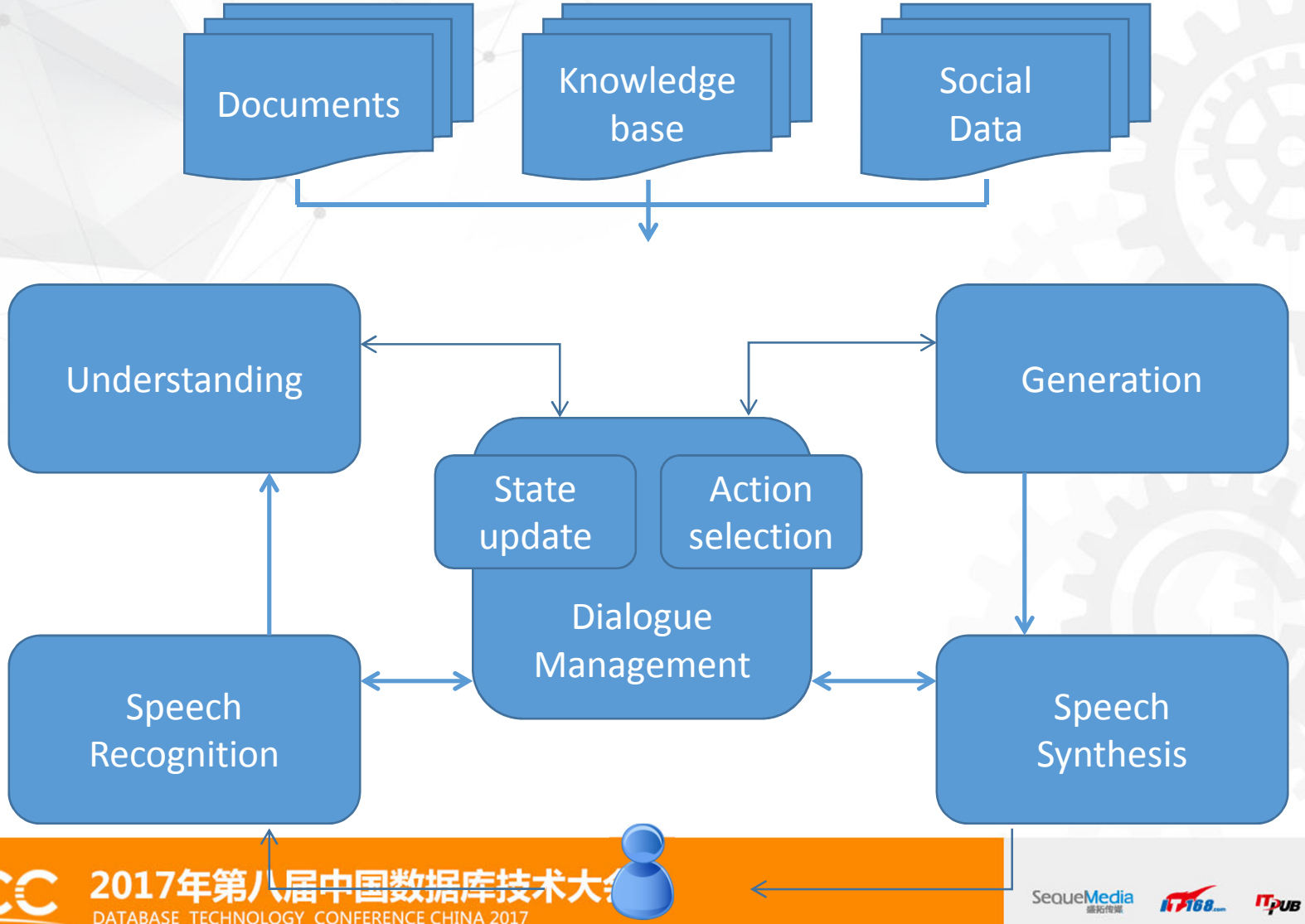
Example

Bai du 百度
吃饭，不要日餐
百度一下
网页 新闻 贴吧 知道 音乐 图片 视频 地图 文库 更多»
百度为您找到相关结果约29,500,000个
搜索工具
吃饭一定要一日三餐吗?_百度知道
5个回答 - 提问时间: 2011年11月05日
最佳答案: 当然不一定,你可少吃多餐,而且科学实验证明这种进食方式对身体很好,一般是一日三餐的,早晨要吃好(早上吃的像皇帝),中午要吃饱(中午吃的像平民),晚上...
更多关于吃饭,不要日餐的问题>>
zhidao.baidu.com/link?... - 百度快照 - 评价
人吃饭要一日三餐,老公做爱为什么不可以做到一日三次..._爱问知识人
2017年3月10日 - 人吃饭要一日三餐,老公做爱为什么不可以做到一日三次呢?buyimeiren ...我想看日本AV,哪位有具体网址? 西片里外国白人、黑人的阴茎那么长,很清楚...
iask.sina.com.cn/b/203... - 百度快照 - 1925条评价
人到了吃饭时间点感觉不饿是不是可以不用按时吃饭?_百度知道
11个回答 - 最新回答: 2015年09月25日 - 4人觉得有用
要按时吃饭才好 追问 我觉得人应该是感觉饿了才吃 按照一日三餐的习俗太束缚...三餐要规律,身体机能才会正常.不饿也要加减吃,才能维持体力到下一餐之前.不要...
更多关于吃饭,不要日餐的问题>>
zhidao.baidu.com/link?... - 百度快照 - 评价
吃日料,你一定用的到的日餐礼仪!-搜狐旅游
2016年4月21日 - 康大豪生嘉禾日餐厅在正式学习日餐礼仪之前,先为您介绍一家地道的日式料理餐厅,位于青岛康大豪生大酒店一楼的嘉禾日料,纯日式装修风格的和室,身着日式服装的服务...
travel.sohu.com/201604... - 百度快照 - 61条评价

Dialogue System Components

- Automatic Speech Recognition (ASR)
  - Recognize voice signal to textual representation
- Natural Language Understanding (NLU)
  - Convert text to semantic representation
- Dialogue Management (DM)
  - Update dialogue state and perform the right actions
- Natural Language Generation (NLG)
  - Select the best answer based on current (state, action)
- Text-to-Speech Synthesis (TTS)
  - Synthesize natural voices using the generated text

Architecture for Dialogue System



Natural Language Understanding

- Definition
  - Convert text to semantic representation
- Challenges
  - Semantic gap between literal text and semantics
- Examples
  - 我想买手机
  - 推荐一款女性手机，不要苹果
  - 有IPhone么？
  - 水果机怎么卖？

NLU Challenges

- Speech Recognition Error
  - Word error rate 10-20%
- Short-text processing
  - Less context
  - Sparsity
- Semantically similar expressions
  - Polysemy
  - Synonyms
- Colloquial transcription
  - Incorrect syntactic parsing

NLU Approaches

- Rule-based methods
  - Expert rules to extract the semantics from text
  - Pros
    - No labeled training data is required
    - Easy to explain
  - Cons
    - Expert knowledge to define general rules
    - Time consuming, over-specified and incomplete

NLU Approaches

- Statistical Methods
  - Train statistical models based on labeled data
  - Pros
    - Less expert involvement
    - Data + feature engineering + algorithm = desired model
  - Cons
    - Labeled training data is required
    - Difficult to explain

NLU as a Service

- Definition
  - Intention identification
  - Entity extraction
- Existing NLU services
  - WIT.AI
  - API.AI
  - LUIS.AI
  - Watson
  - Alexa

Comparison of NLU services

Services	Free or paid	Multi-language	Basic functionality	User-defined	Reference
WIT.AI	Free	Yes, 11	Intent, entity, context, action	Intent, entity, context, action	https://wit.ai
API.AI	Paid	Yes, 14	Intent, entity, context, action, text2speech, speech2text, cross-platform	Intent, entity	https://api.ai/
LUIS.AI	Free	Yes,	Intent, entity, cross-platform	Intent, entity	https://www.luis.ai/
ALEXA skill set	Free	Yes,	Intent, entity, household platform	Intent, entity, action	https://developer.amazon.com/alexa-skills-kit
WATSON AlchemyAPI	Paid	Yes,	Intent, entity, relation, sentiment	Not yet	http://www.alchemyapi.com/api

Dialogue Management

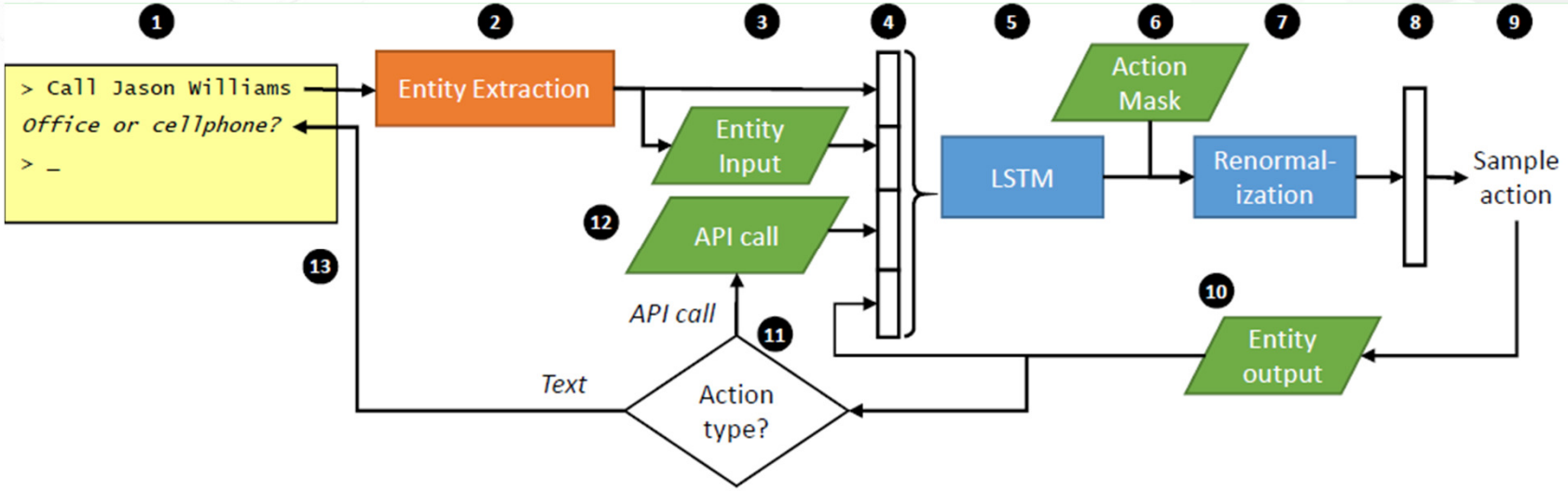
- Brain of the Dialogue System
- Dialogue State Update
  - DM maintains current dialogue state
  - DM updates the state as new input arrives
- Action Selection
  - Make decisions based on current state and input

DM Approaches

- Frame-based method
  - Frame is a set of slot-value pairs
  - Frame is gradually filled by the multi-turn request-response pairs
  - Pros
    - Easy to implement
  - Cons
    - Difficult to extend to other domains

DM Approaches

- Neural network learning approach
  - Formulated as a sequence labeling problem
  - Predict the next action based on (input, state, etc)



Natural Language Generation

- Definition
  - Given input, create a natural language expression that is well-formed and human-readable
- Possible input
  - User utterance
  - User profile
  - Dialogue state
  - Communication goal
- Generated output
  - Passage or sentence
  - Answer in knowledge base
  - Automatic summarization

NLG Pipeline

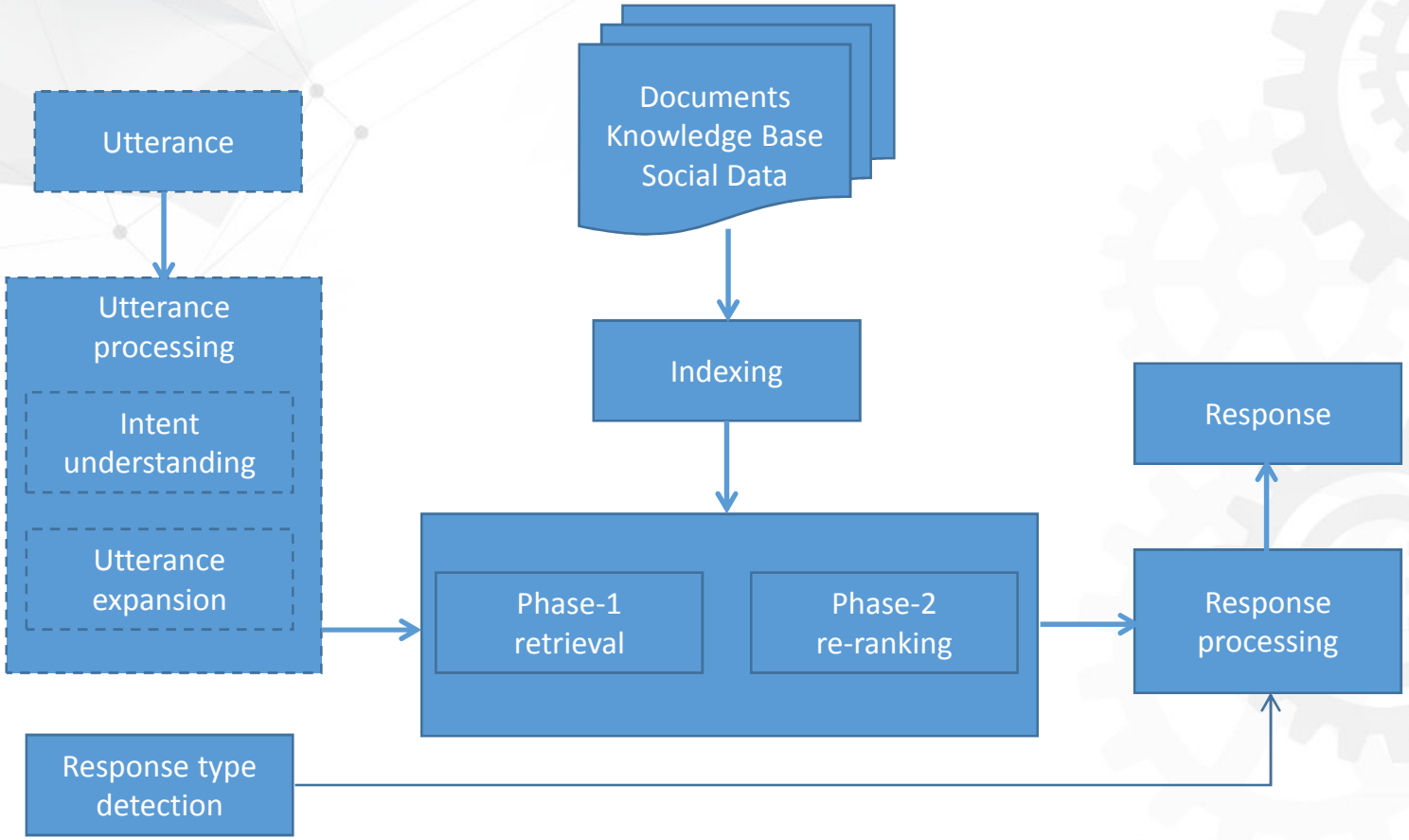
- [Input]
  - Content/Text planning (what to say)
    - Intent, entity, context, goal, etc
- [Text plan]
  - Sentence plan/realization (how to say)
    - Sentence selection, re-ordering and ranking
- [Rendering]
  - Surface plan/realization (how to present)
    - Response decoration

NLG Approaches

- Retrieval-based methods
  - Fixed response set
  - Closed-domain
  - Professional assistant
- Generation-based methods
  - Dynamic responses
  - Open-domain
  - Social assistant

NLG Approaches

- Architecture for retrieval-based methods



AI+HI in Dialogue System

- Current working model
  - Completely HI
  - AI + HI
  - Completely AI
- Proposed working model
  - Group chat involving user, bot and human agents
  - Bot activates the human agent involvement
    - Based on context, user profile and agent expertise
    - AI + HI = MI, Mixed Intelligence

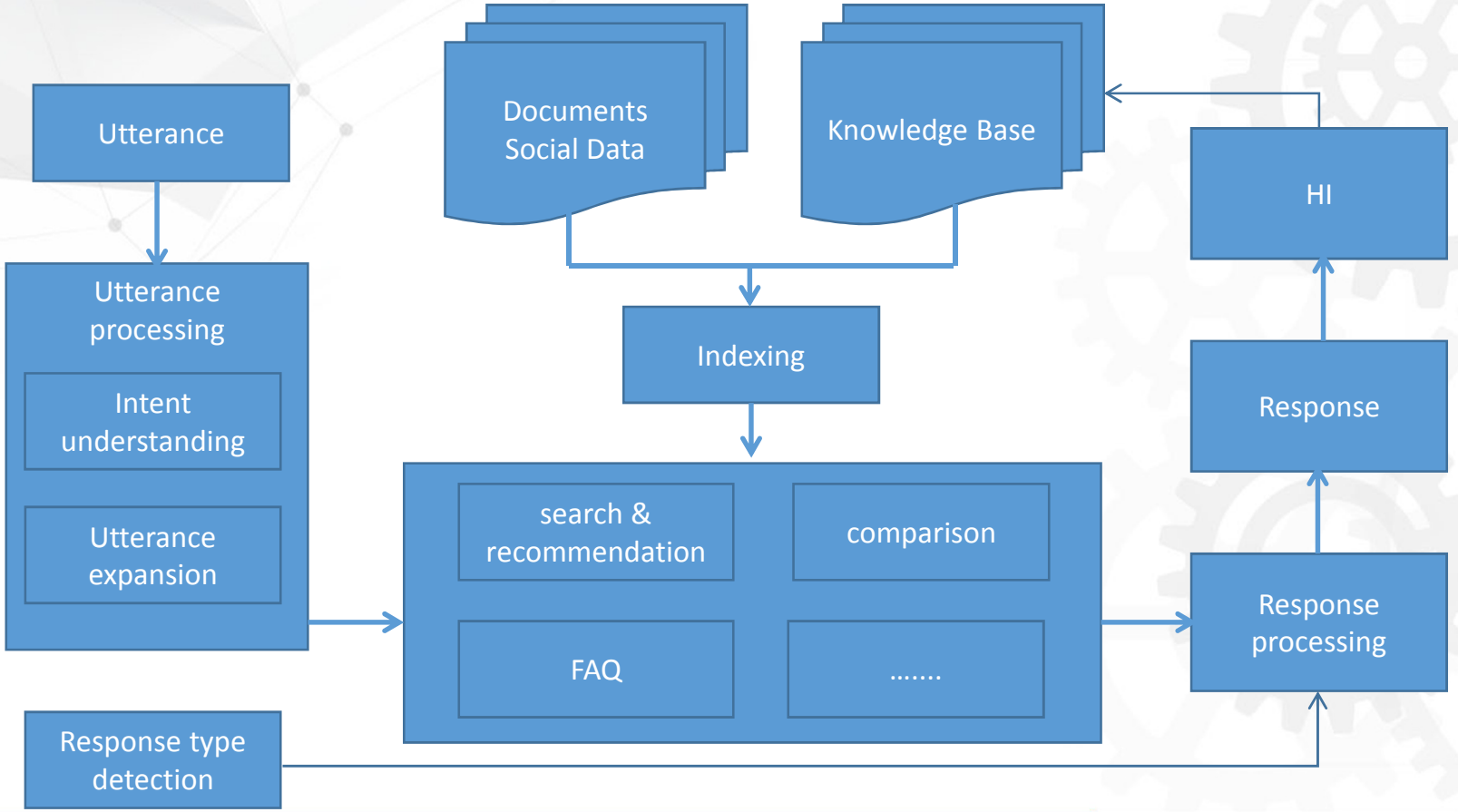
Mixed Intelligence Architecture

- MI = AI + HI

HI Human Intelligence

Retrieval-based Dialogue System

- Basic architecture



Evaluation of Dialogue System

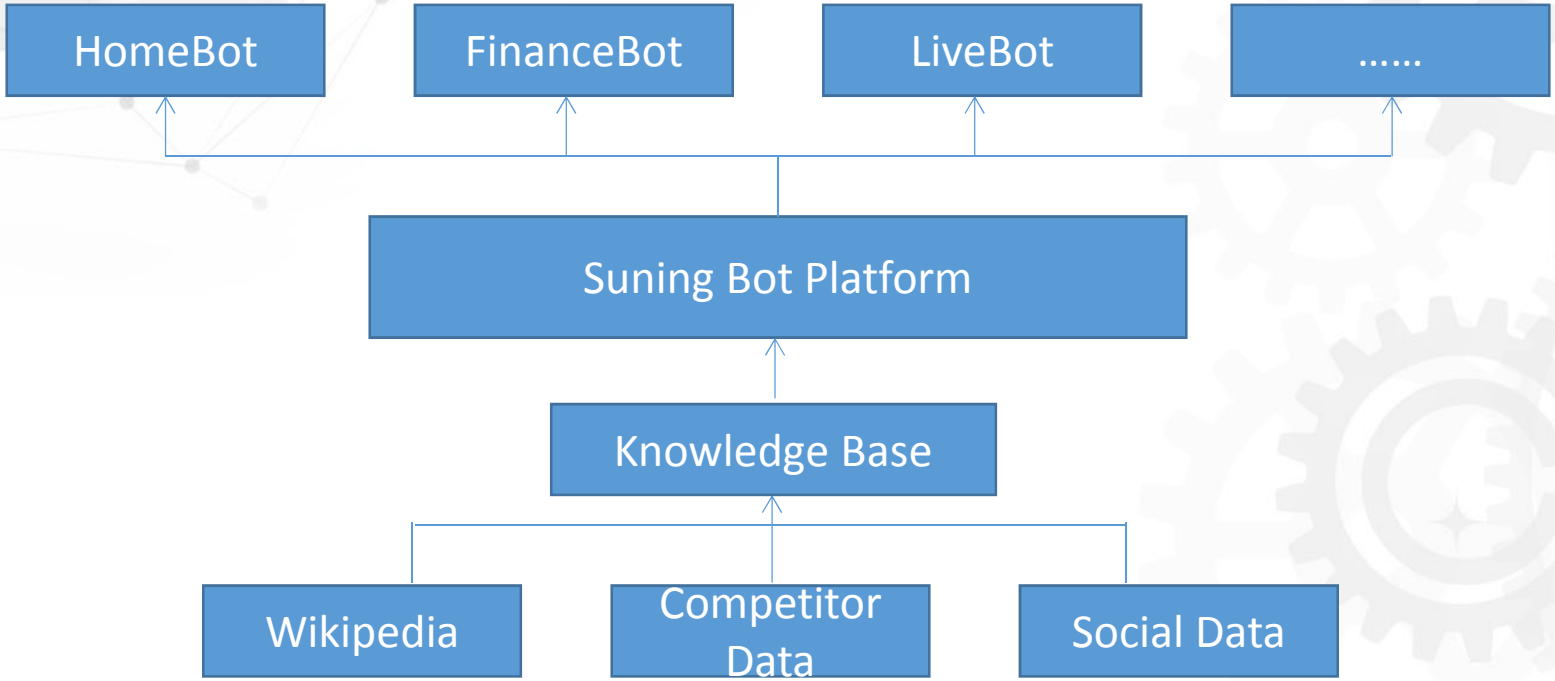
- Data
  - SQuAD, Stanford Question Answering Dataset
  - TREC QA, Text REtrieval Conference QA dataset
  - bAbi, Facebook QA dataset
- Offline evaluation
  - Model evaluation metrics
- Online evaluation
  - User engagement
  - Conversion rate

Application Scenario

- Characteristics of AI
  - Work anytime, 7/24
  - Big memory
  - Consistency
- Suitable tasks
  - Simple, routine work
  - High concurrency, large traffic

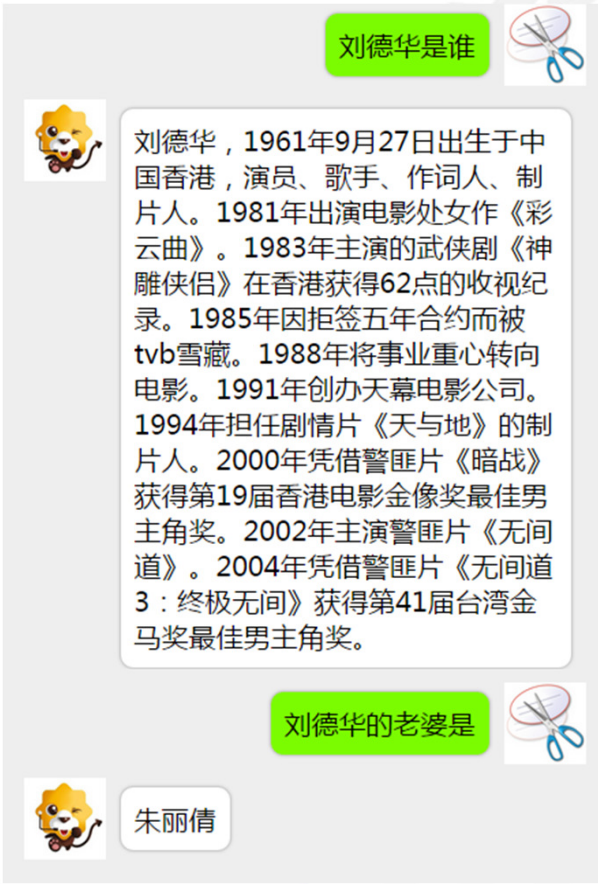
Suning Bot Platform

- XBot Platform
  - HomeBot, FinanceBot, LiveBot and AdsBot, etc



Simple Demos

- 小苏-智能机器人



THANKS
SequeMedia
盛拓传媒
IT168.com
ITPUB
ChinaUnix