Cybernetics and Cyberspace

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bookend

In a world of increasingly volatile and massive data, our system´s capability may be pressurised. However if we can cope with these conditions, e.g. with the help of machines and improved self-understanding, then they may also provide opportunities. To optimise the situation we need to see the relation between our mental apparatus and emerging conditions, and the cybernetic loop is introduced here as having explanatory and operational value.

§0. introduction

§ 1. We are cybnetic organisms in a chaotic world.

§ 2. This creates both opportunities and dangers.

§ 3. The situation can be modulated in two main ways: machine enhancement & human enhancement.

§1. cybernetics and chaos

§1.1 cybernetics

This is the science of control, communication, and adaptivity in systems which may be biological, mechanical, digital, social, macroscopic, microscopic, etc.

Its essential concept is that of the feedback loop in which:

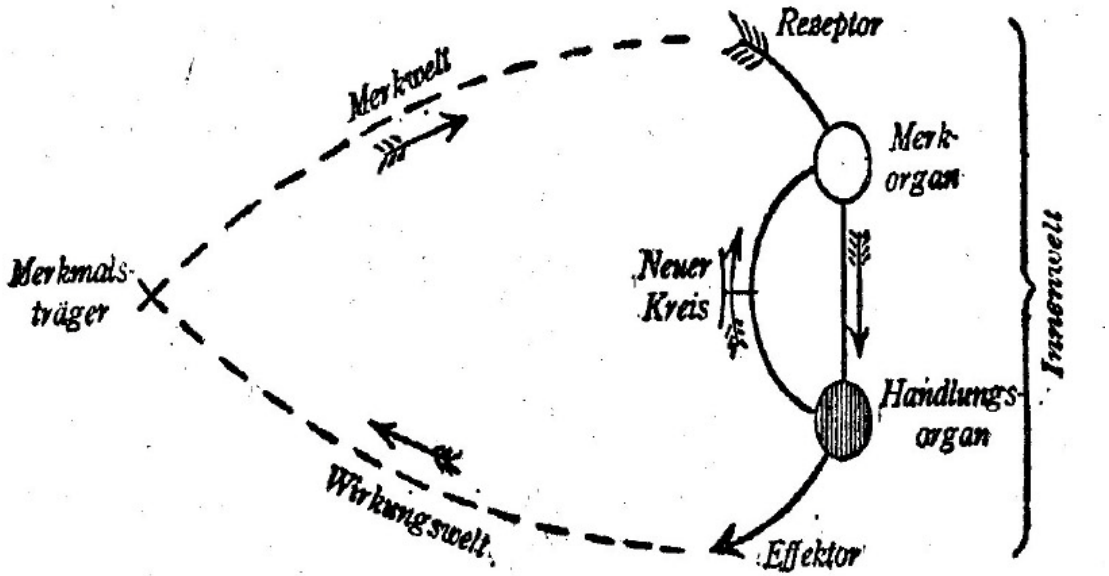
- a system generates an action
- the action generates change in the environment
- the change is sensed, fed back to the system, and compared with the system´s goals
- a system change is generated
- new action is produced.

Comments (DMP):

- The effect on the environment depends not only on the action but on the current situation/context.
- There is a middle way in response to feedback.

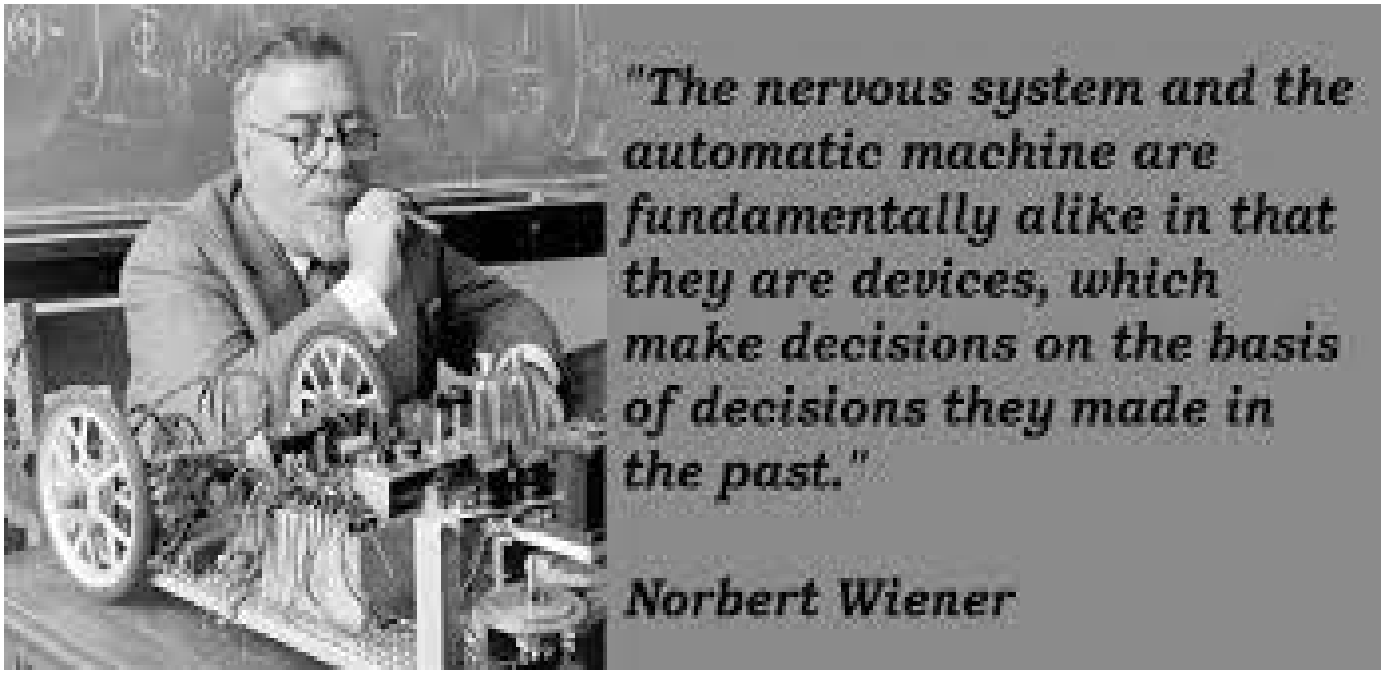
Jakob Johann von Uexküll

Uexküll introduced the concept of the feedback loop:

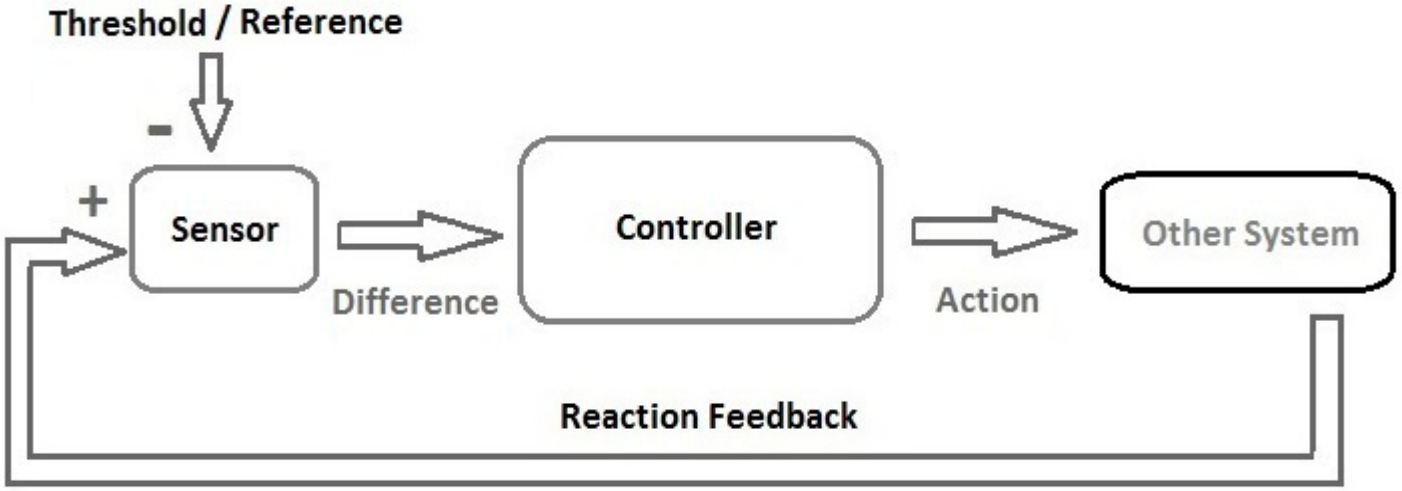


Figur 4.

Norbert Wiener



Wiener applied this in the science of cybernetics:



A Cybernetic Loop

§1.2 chaos

The technologies of cyberspace are **ARUC** (artificial intelligence, robotics, ubiquitous computing, and communications).

These have created information-conditions which are **MVIF** (massive, volatile, immediate, and fragmented).

As such, these technologies and the conditions they create provide opportunities and dangers.

§2 opportunities and dangers

§2.1 opportunities

The opportunities of the cognitive era need hardly be stated. These are commensurate with earlier technologies. Some examples:

opportunities	
Education	Access to information. Support for teaching.
Work	Labour is reduced. Safety is improved.
Health	Discovery of new drugs. Tele-medicine. Diagnosis. Operations.
Wellbeing	Entertainment. Communication. Communities.

§2 opportunities and dangers

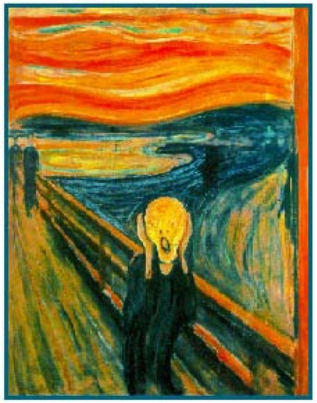
§2.2 dangers

The dangers of the cognitive era are also obvious. Some examples:

dangers	
Education	Impersonal, superficial, detached.
Work	Employment is lost. Selective effect. Early education is inadequate.
Health	Mental health and chaos. Cyber-stress. Cyber-recluse syndrome. Internet addiction. Superficial relationships.
Wellbeing	Disenchantment (Weber), superficiality, logocentricity.

a good fit?

↔



We are in a cybernetic loop with our environment.

This environment now includes ARUC which creates cyberspace.

If the fit is not good, then it should be optimised, to increase benefit and decrease harm.

Under MVIF conditions our data-scope is widened, accelerated, and complicated.

The consequences for the cybernetic loop are that:

- the cybernetic tasks of collecting, interpreting and applying feedback in context are magnified
- this creates the risk of overload
- and it creates the opportunity for enhanced performance.

a challenge

One function of cognition is to adjust action so that its effects in context are optimised better to fit our goals.

MVIF conditions are therefore a challenge to the loop, since the data-scope for determining an action´s effects and relevant contexts is widened, accelerated, and complicated.

We now turn to two strategies for supporting the loop: machine enhancement and human enhancement.

§3. enhancement

§3.1 machine enhancement
§3.1.1 intelligent agents

Can we use machines to reduce the problems created by machines?

One possibility is intelligent agents. These are like a butler or PA. They get to know the individual and their typical tasks, locations, etc. They filter and search cyberspace in the background, organise and present when needed. Essentially they are intended to mediate between the individual and cyberspace, giving us "mediated life in the cognitive era".

In cybernetic terms, this is loop support: the agent is proposing actions for the owner which should produce optimised results in context, thus simplifying the owner´s loop with the world.

§3.1.2 cognitive computing

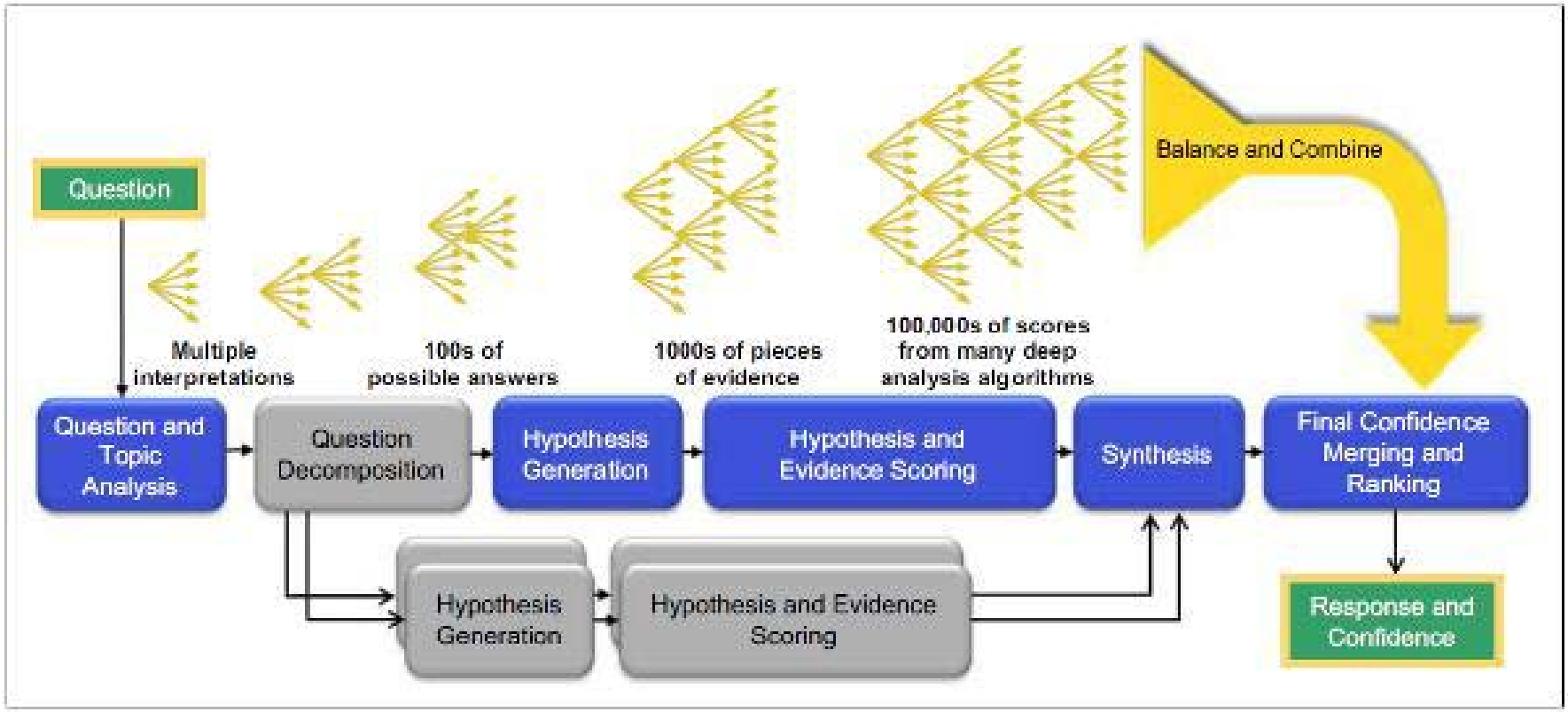
Another possibility is cognitive computing. Like many technologies, this is, or should be, an enhancement to our natural capabilities.

A prominent example is the IBM Watson system. This is already in use in several industries. The basic architecture is:

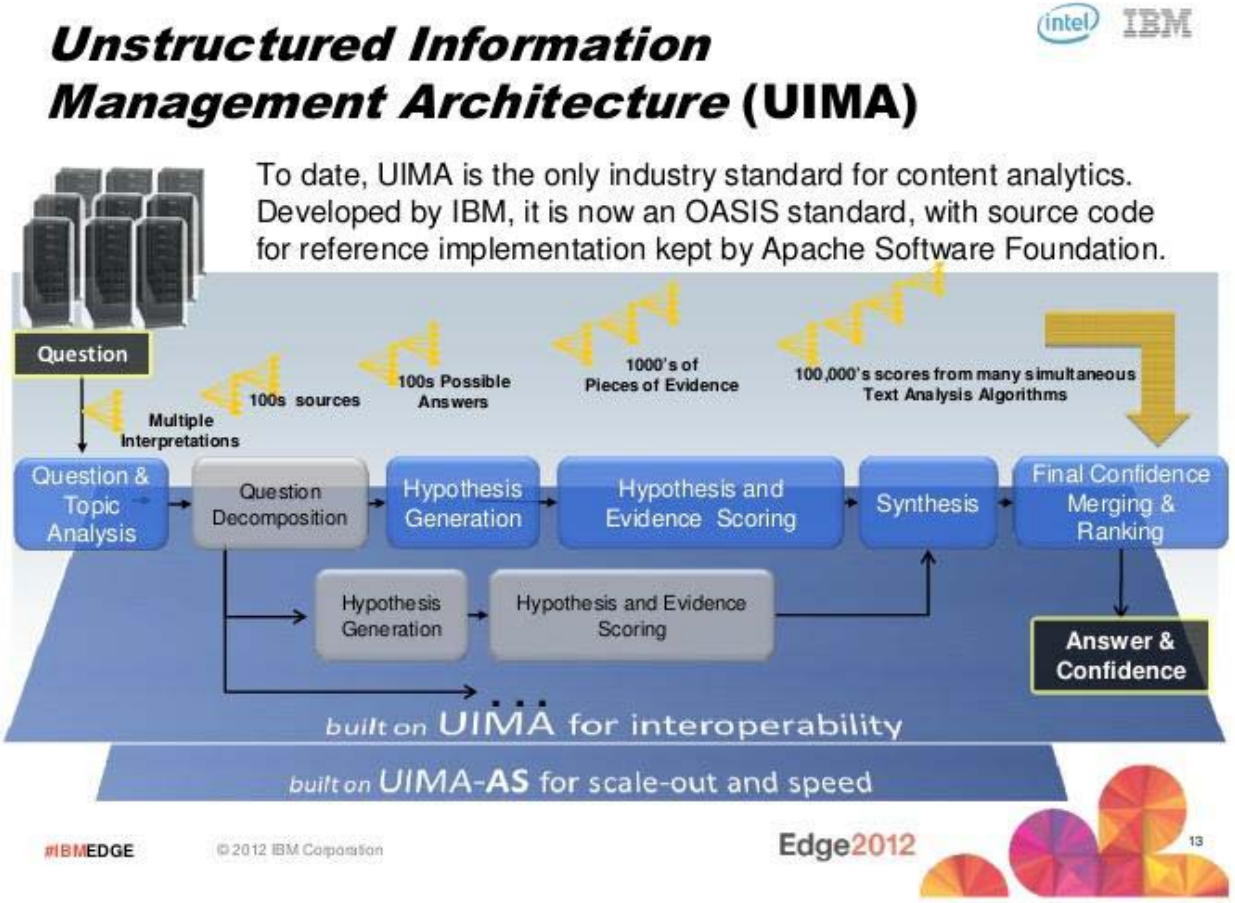
- natural language processing
- big data analytics
- probabilistic reasoning
- parallel hardware

This is machine extension of our basic cyborg loop. One of its mechanisms is the candidate-generation-selection-pipeline, as follows (next sides).

IBM Watson architecture



UIMA


Unstructured Information Management Architecture (UIMA)
intel
IBM
To date, UIMA is the only industry standard for content analytics. Developed by IBM, it is now an OASIS standard, with source code for reference implementation kept by Apache Software Foundation.
Question
Multiple Interpretations
100s sources
100s Possible Answers
1000's of Pieces of Evidence
100,000's scores from many simultaneous Text Analysis Algorithms
Question & Topic Analysis
Question Decomposition
Hypothesis Generation
Hypothesis and Evidence Scoring
Synthesis
Final Confidence Merging & Ranking
Hypothesis Generation
Hypothesis and Evidence Scoring
...
Answer & Confidence
built on UIMA for interoperability
built on UIMA-AS for scale-out and speed
#IBMEDGE
© 2012 IBM Corporation
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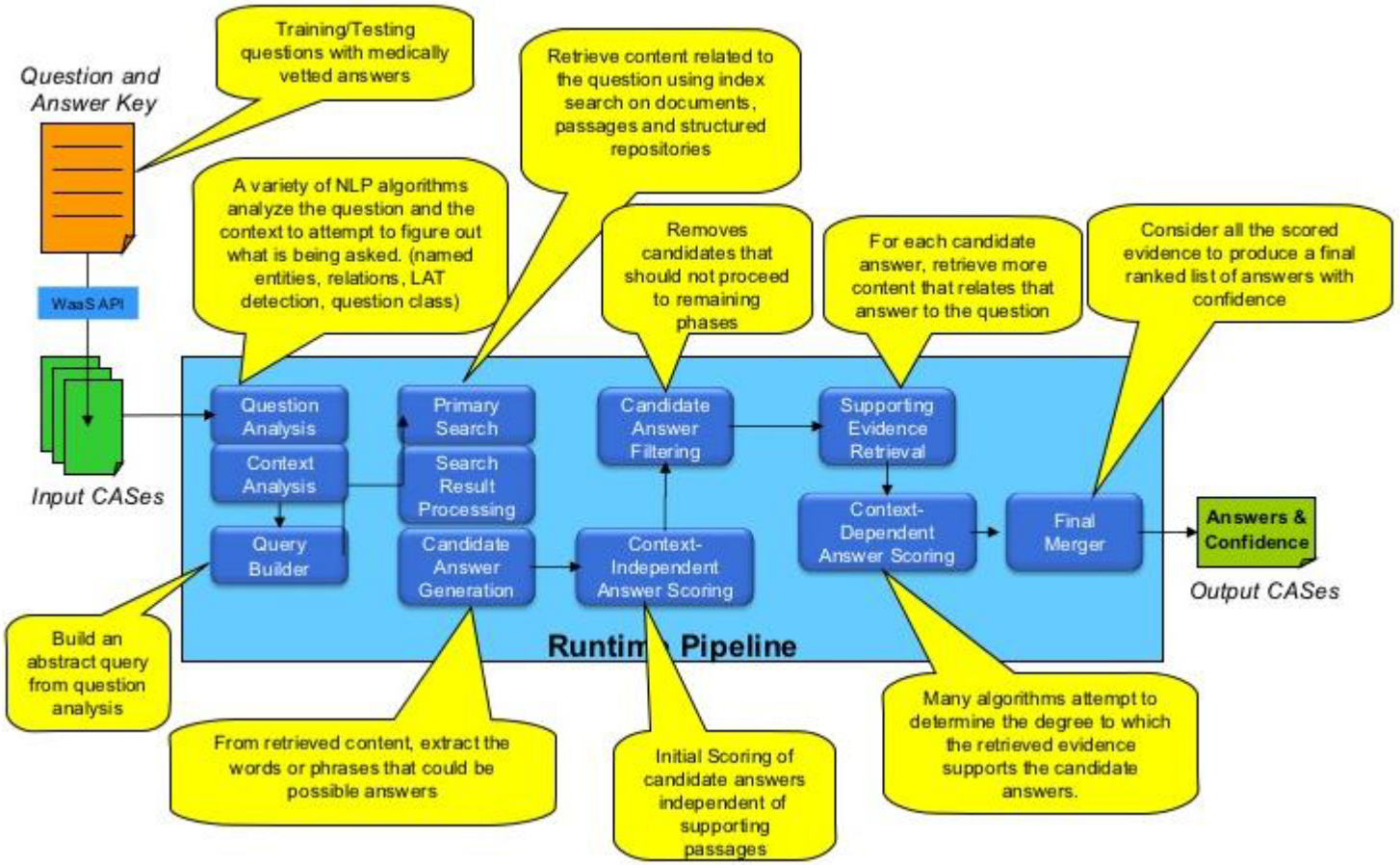
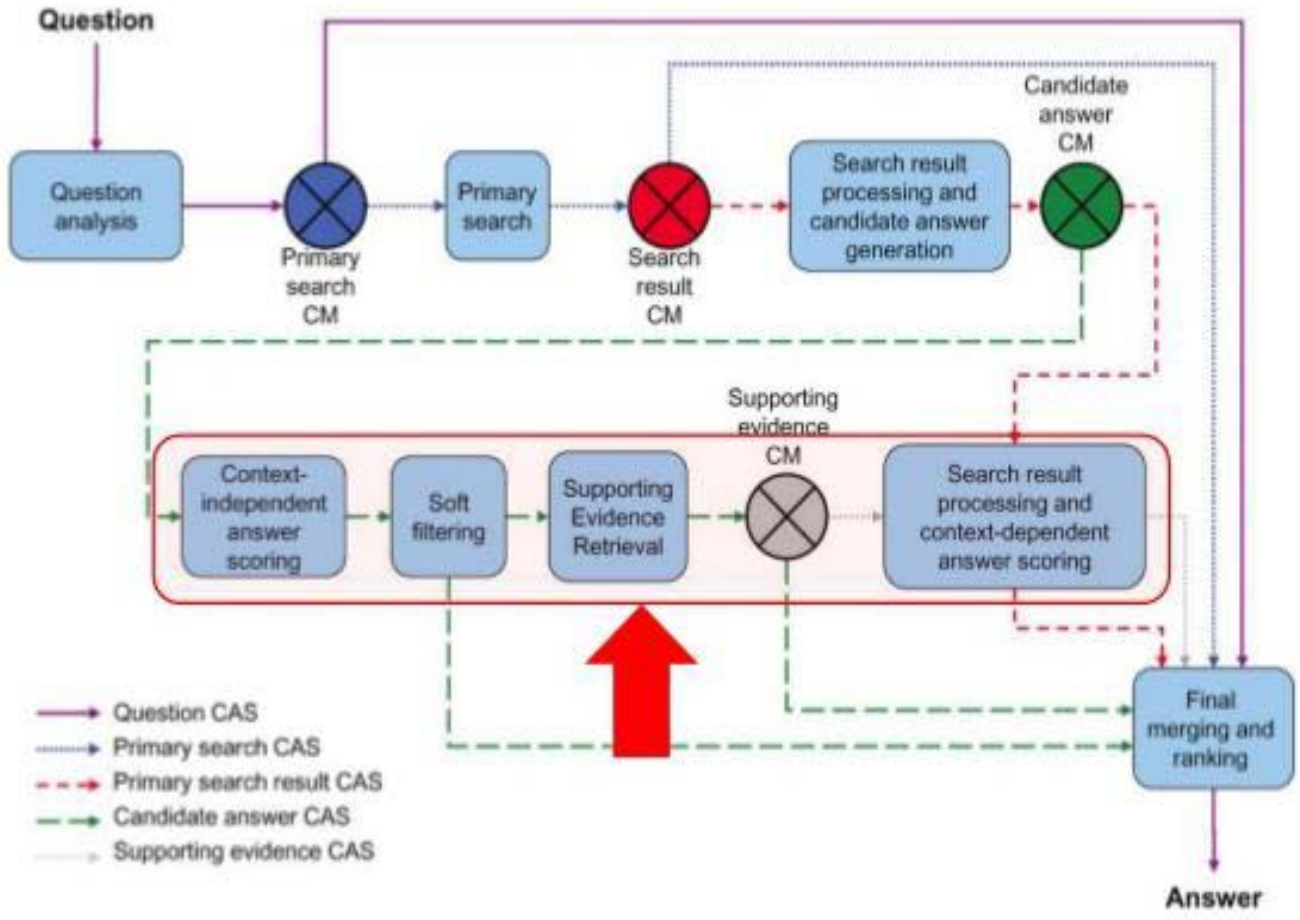
CGSP


Question and Answer Key
Training/Testing questions with medically vetted answers
Retrieve content related to the question using index search on documents, passages and structured repositories
A variety of NLP algorithms analyze the question and the context to attempt to figure out what is being asked. (named entities, relations, LAT detection, question class)
Removes candidates that should not proceed to remaining phases
For each candidate answer, retrieve more content that relates that answer to the question
Consider all the scored evidence to produce a final ranked list of answers with confidence
WaaS API
Input CASes
Question Analysis
Context Analysis
Query Builder
Primary Search
Search Result Processing
Candidate Answer Generation
Candidate Answer Filtering
Context-Independent Answer Scoring
Supporting Evidence Retrieval
Context-Dependent Answer Scoring
Final Merger
Answers & Confidence
Output CASes
Runtim Pipeline
Build an abstract query from question analysis
From retrieved content, extract the words or phrases that could be possible answers
Initial Scoring of candidate answers independent of supporting passages
Many algorithms attempt to determine the degree to which the retrieved evidence supports the candidate answers.

ranking


Question
Question analysis
Primary search CM
Primary search
Search result CM
Search result processing and candidate answer generation
Candidate answer CM
Supporting evidence CM
Context-independent answer scoring
Soft filtering
Supporting Evidence Retrieval
Search result processing and context-dependent answer scoring
Final merging and ranking
Answer
Question CAS
Primary search CAS
Primary search result CAS
Candidate answer CAS
Supporting evidence CAS

logic

Does this candidate-generation-selection-pipeline (CGSP) implement a type of deduction, induction, or abduction, or all of them at once?

Oswaldo Pessoa has pointed out that the logic generated by Watson´s CGSP is hypothetico-deductive, since a (large) set of hypotheses (candidates) is generated, and then (through scoring and ranking) a favourite is selected.

§3.2 human enhancement

Can we fortify ourselves better to survive the chaos of cyberspace?

- **Philosophy.** E.g. Epictetus: "It's not what happens to you, but how you react to it that matters." (Enchiridion, Arrian). This implies the personal responsibility of the cyber-stoic.
- **Education.** "Cyberology" could be taught in school. This could include "cyber-sense", the deliberate, methodical use of new technologies.

This is short mention of a large topic.

a one-sided coin?

Most technologies are **ditropic**: they may produce good effects, bad effects, or both according to how they are used, in what situations they are used, how they are used, and what goals we have.

Our ethical task, then, is **steerage**: directing what we have to good effect.

Our futurist task is **predictive steerage**: preparing ahead of time for conditions which will follow.

ditropism

By ´ditropic´ I mean that one thing may have good effects, bad effects, or both, according to the context in which it is used (and how it is used).

Most or even all technologies are ditropic, rather than being inherently good or bad, and it is our responsibility to steer their utilisation, and re. the near future to provide predictive steerage.

The logical form of ditropism is:

$$\forall t(\exists c_1,c_2(U(t,c_1) = \checkmark \ \& \ U(t,c_2) = \times))$$

where: t = technology, c = context, U = utilise.

bookend

In a world of increasingly volatile and massive data, our system´s capability may be pressurised. However if we can cope with these conditions, e.g. with the help of machines and improved self-understanding, then they may also provide opportunities. To optimise the situation we need to see the relation between our mental apparatus and emerging conditions, and the cybernetic loop is introduced here as having explanatory and operational value.

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