Agent Applications

Overview

Social Agents

Business Applications

Agents in Medicine

Manufacturing Agents

Military Agents

Social Agents

Interaction with Humans

Eliza

engages in conversations with humans

Julia

MUD player ("chatterbot)

Shallow Red

sales agent

Kismet

one of MIT's sociable agents

Eliza

grandmother of conversational agents

conversation

natural language communication between human and agent

goal

simulates a psychotherapist
answers questions frequently with counter-questions

interactivity

programmed responses to keywords and sentence structures in the user's questions

resources

originally only a few hundred lines of code

has generated many offsprings and clones

Julia

one of the first chatterbots

MUD player

connects to a MUD just like a human player

runs on various MUDs

social agent

interacts with players just like another player

communication

text-based (limited) natural language

social skills

programmed to conform to accepted behavior in MUDs

Shallow Red

sales agent for Neuromedia, Inc.

goal

answers basic questions about Neuromedia's products

implementation

runs as a script on an agent engine

separation of content and AI technology

configuration

can be adapted to specific tasks by changing the underlying content

technology used stays largely the same

interaction

much more realistic than Eliza

superceded by Nicole, Neuromedia is NativeMinds now

Business Applications

for Agents

Business Issues

Potential Applications

Benefits and Risks

Case Study: BargainFinder

many potential applications in e-commerce

Business Issues

money

on-line transactions

charges as flat fee / per transaction / per resource usage

efficiency

improve the quality of the work done by knowledge workers

relief from mundane tasks

information usage

make the best use of all the available information about customers, products, processes, marked, competition

business environment

continuously changing

may become difficult for humans to keep up

Trading and Negotiation

negotiation strategies
- derived from game theory
- based on experience

learning from experience
- statistical evaluation of previous transactions

goals
- goal-based instead of command-based
- goals may be complex (hierarchies, priorities)

language
- exchange of information, negotiation

Applications

for agents in business

watchers
observe users' activities, suggest improvements
but: Big Brother

advisors
provide help and training on the spot

information gathering data mining
evaluate large collections of data for useful knowledge

transaction proxies
agents that act on behalf of the user

smart shopping
identify, locate, evaluate and compare goods for the user
may perform additional functions like negotiations

sentinels

monitor events for the user

alerts for exceptional conditions

Data Mining

extract useful information from huge quantities of data

information storage

can become the dominant cost factor for computer systems

may contain a lot of useful information, but it is often difficult to find

retrieval

new discoveries or insights

not only answers to specific queries

business transactions

extract demographic information, trends

Communication

enhanced by agents

pull

agent goes out and locates useful information

active extension of filtering engines

push

an agent is used to distribute information that is thought to be useful to the user

targeted advertising ("intelligent spam")

development of electronic communities

Acquisition

and use of agents

custom development
: individualized construction of agents for a particular user

toolboxed
: agents are put together from predefined components

mass-produced
: agents are bought and sold just like other products

leasing
: permission to use an agent for a certain time for a fee

usage-based fees
: depends on how often / hard the agent is used

Benefits

of agents in business

multiple transactions

agents may be able to work faster than humans

agents working in parallel allow several simultaneous transactions

transaction size

micro-transactions become feasible

e.g. purchase of individual articles instead of newspapers

noise reduction

info-junk seems to grow exponentionally, useful content only linearly

agents can helpo with searching and filtering information

consistency

no changes in the behavior of an agent due to emotions, moods, fatigue, hunger, thirst

learning

improvement of performance through tuning by
the user,
individual adaptation of agents,
evolutionary adaptation of agent species

efficiency

agents take over mundane tasks, allowing the
user
to concentrate on essential work

collaboration

disruptive effects of time and space can be
reduced

Risks

of agents in business

new technology

early stages of development

bugs, lack of experience

scalability

solutions with few agents may not work for large numbers

privacy

agents may violate privacy of individuals

security

information in agents may be accessed in an unauthorized way

access by agents to protected information

liability

responsibility for the actions of an agent

information overload

agents not only reduce, they also produce

information

expectations

may be overinflated

anthropomorphism

agents may be perceived as personas

unknown risks

there may be unforeseen consequences of using agents

Outlook

for agents in business

technical advancements

agent architectures, toolsets

agent interaction

infrastructure

agent virtual machines, meeting places,

electronic (micro-)payments

integration

strategy, people, processes

organizational acceptance

legal issues

responsibility and liability

intellectual property and copyright

Intrusion Detection

identify suspicious events on a network

event filtering

screening of audit data and logs for unusual activities

remote control

initiate action against intrusions on network nodes

distribution

update of intrusion profiles, countermeasures

analysis

off-line analysis of logs

example: SNARE
(`http://www.intersectalliance.com/`,
`http://www.intersectalliance.com/resources/Documentation/Snare_Toolset_White_Paper-2.3.pdf`)

BargainFinder

http://bf.cstar.ac.com/bf

purpose

information integration agent
electronic intelligent agent for automatic
price-gathering and comparison shopping

design

get query from the user
convert it into the format of the stores' search
engines
search stores in parallel
retrieve results
consolidate results for the user
provide links for follow-up actions

advantages

efficiency: search several stores simultaneously
customers can be better informed

problems

not all stores like it

may be unfair to stores who charge higher
prices because of superior service
price may not be the only purchase criterion

Medical Agents

Overview

goals

Why agents in medicine?

applications

surgery, nuclear medicine, intensive care

hospital information systems

management of data for entire hospitals, health groups

personal medical information systems

individualized information and advice about health
tracking of health-related personal data
coordination of complex treatments

Goals

for agents in medicine

patient treatment

aid with complex treatment plans

computerized equipment

make the use of complicated technology easier

administration

coordination of distributed information

user autonomy

independent, private collection of health information for individuals

Surgery Robots

go where the doctor can't (or won't)

access

surgery robots can reach body parts that are not accessible to conventional surgery

less invasive

smaller openings required

less traumatic for the patient

possibly safer

speed

robots may be faster

precision

robots are capable of better controlled movements

remote operation

robots can be used in locations away from the doctor's office

Technical Aspects

of robot surgery

task definition

usually done by a medical expert

may involve virtual reality, 3D mapping

task planning

high-level planning by the doctor

specific actions possibly by the robot

task execution

performed by the robot

independently, or with interaction from the doctor if necessary

Emergency Surgery

critical constraints

location

surgery can be performed close to the site of an incident, even if no doctor is at the location

patient transport

greatly reduced, decreasing the risk to the injured

resource utilization

more effective use of specialists

safe and familiar work environment for the doctor

infrastructure

requires some basic facilities and communication methods

e.g. video conferencing, remotely controlled surgery bots

Agents in Nuclear Medicine

control of complex treatment processes

treatment plan

development and supervision of an
individualized plan for a particular patient
involves doctors, technicians

delivery of radiation

create distributed, focussed radiation beams
that can destroy tumors with minimal effects on
surrounding tissue

remote operation

technical personnel should be away from the
patient

Example: Therac 25

Agents in Intensive Care

goals

- constant patient supervision
- patient comfort
- adequate supply of nutrients, drugs
- removal of waste products

patient supervision

data collection and analysis

system control

complex mechanical, chemical, electronic systems (e.g. cardiovascular, respiratory support)

Hospital Information Systems

integration of all kinds of hospital information

clinical information

patient records

medical information

access to domain expertise

financial information

billing system

administrative information

employees, schedules, procedures

privacy and security issues

Personal Medical Information Systems

keeping track of a person's health

data collection
maintains all collected medical data for an individual

medical advice
medical domain knolwedge directly available

diagnostic support
may help the doctor with the diagnosis

treatment supervision
scheduling and administration of treatment plans

Benefits and Risks

of agents in medicine

benefits

- increased availability of economical specialized treatment
- les traumatic surgery
- better control of complesx

risks

- new technology
- acceptance
- over-reliance

Military Agents

Robots instead of Soldiers?

Information-based Warfare

Peacekeeping Agents

Logistics Agents

Underwater Agents

Airborne Agents

Information-based Warfare

direct integration of information

battlefield

becomes much larger

possibly no direct contact with the adversary

weaponry

remotely controlled, "intelligent", capable of striking deep in the opponent's territory

attacks

may be directed against military or non-military targets

command and control

shoft from "command by direction" to "command by influence"

Command by Influence

don't tell me what to *do*, but what to *achieve*

concept

distribute the intentions of the commander to small units

tasks

units pursue their tasks and goals more independently

resources

requires small, but well-trained troops

indirect management

instead of direct manipulation

Battlefield

environment for military agents

challenges

chaotic, noisy, non-deterministic, continuous, insecure, ...

dominant battlefield awareness

better information than the opponent

mission-specific units

forces tailored to a particular task

theater missile defense

protection of friendly forces from missile or other attacks

Peacekeeping Agents

Example: Bosnia

constraints

the use of military force is restrained

relevance of information

becomes much more critical since "brute force" is often not an option

protection of friendly forces

requires preparedness for military action

may be in conflict with other tasks

international collaboration

communication in different languages between different cultures carried over various infrastructures

Logistics Agents

get the material to the right place in time

transportation assets

location and dispatch of vehicles

properties and constraints of vehicles

material

location and acquisition conditions for the required material

route planning

determine the best way to transport the material from its current location to the destination

delivery decisions

combinations of shipping and product options

mode of transportation

delivery monitoring

delivery status, potential alternatives

Underwater Agents

submarines and anti-submarine warfare

undersater search

small amount of useful information hidden in an abundance of raw data

multi-target tracking

keeping in touch with several targets simultaneously

information integration

data fusion

knowledge integration

generation of a user-friendly display

Airborne Agents

external environment

large quantities of data

limited perception capabilities of the pilot

(speed, quantity)

internal environment

status of the plane, payload

cooperation

with other friendly pilots, support personnel

under limited bandwidth, changing conditions,

stress

confrontation

reliable identification of unknown aircraft

combat

fighting in the air

Manufacturing Agents

industrial robots

Physical Agents

agents with a body, actuators

body

mechanical structure

depends on the task and environment

sensors

provide external information about the environment

internal information about the agent's own state

actuators

perform actions on the environment

e.g. grippers, wheels, buzzers, speakers, lamps, sprayers, ...

power supply

battery, power generator, wired power supply

controller

microprocessors for sensory information processing, data and information storage,

construction of a world models, planning,
reasoning, communication, control of actuators