Layered Network of Representatives for Control of Robot

Shinji Karasawa

ABSTRACT

A decoder translates to one output from many inputs. Concurrent excitations of neurons, such as eyes and ears, are decoded by an annex neuron in a brain [1]. The pattern of data to decode is memorized in newly added circuit. Such reaction can be understood as a representative of intelligence. Subroutine in program will correspond to a series of such reactions. The intelligent system is created by bottom-up. But it is operated by top-down. Output of representative is able to assign a series of reaction in lower layer. The reaction in bottom layer is operated along real time. As for upper layered activation, the next operation is started by a signal of the next segmentation. The system of layered representatives can economically achieve many of reliable signal-processing [2].

ARCHITECTURE OF LAYERED REPRESENTATIVES FOR CONTROL

An intelligent system is formed by a process of bottom-up. But it is replayed by a process of top-down where the activations are overlapped as shown in Fig 1.
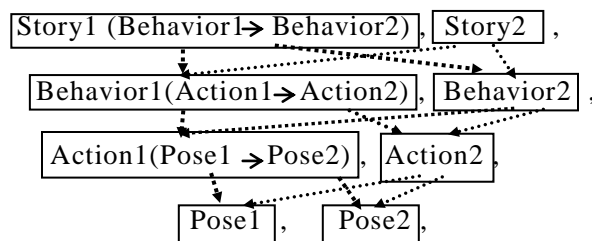

Fig.1. Layered representatives for control of robot. (The arrows are state of replaying.)

Shinji Karasawa, Miyagi National College of Technology (Professor Emeritus),
1-3-6, Oyama, Natori City, Miyagi Prefecture, 981-1233 Japan

A PROGRAMMING FOR BASIC ACTION

```
              ┌─────────────────┐
              │  Start  (Pose 0) │
              └────────┬────────┘
                       │
┌──────────────────────┴──────────────────────────────────┐
│ Pose 1 [Angle of joint 1; Angle of joint 2; · ; · ; · / Transition  time] │
└──────────────────────┬──────────────────────────────────┘
                       │
┌──────────────────────┴──────────────────────────────────┐
│ Pose 2 [Angle of joint 1; Angle of joint 2; · ; · ; · / Transition  time] │
└──────────────────────┬──────────────────────────────────┘
                       │
              ┌────────┴────────┐
              │  End  (Pose 2)  │
              └─────────────────┘
```
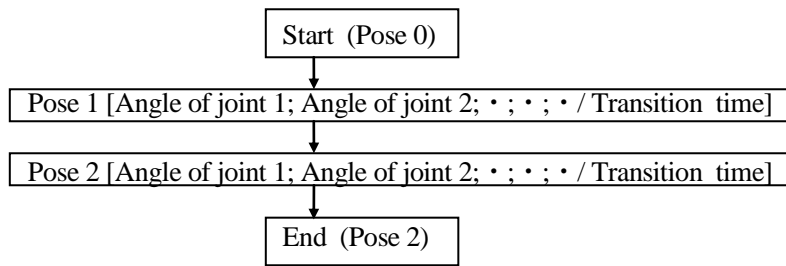
Fig.2. An action is programmed by changes of pose together with the transition time.

The subroutine of an action is described by the transition time and change of states. A transition time of the action is concerned with a period of segmentation of the sound.

STEPS ON IMPLEMENTATION OF THE PROGRAMMING

Dance with music is implemented in a series of basic actions. Here, each step of basic action assigns the change of poses as shown in Fig.2. But in this case, each action is accompanied with music through calling the name of sound file. At first, each sound is implemented into individual action at standing pose. After that, the choreography was carried out by changing the pose of standing. Such temporal program needs some improvements. The improvement includes change of the period of fundamental unit.

TIMING CONTROL OF THE DANCING ROBOT

The work of programming becomes facilitate by fixing the period of transition. The sound data were divided into a series of files in order to mix with the series of actions. The human does not recognize small time lag in vision. So, the period of fundamental unit for one action was selected as 0.5 seconds. Here, the data of sound was obtained via sound recorder in a digital computer. The data of sound was compressed to AD PCM-Microsoft in order to decrease the amount of data. The sound of 0.5 seconds was processed in short time by today's microprocessor. The 0.5 seconds of a sound and the action are started at the same time. Some periods of action were changed to order to adapt with the rhythm of music as needed.

As for the other period of fundamental unit step, we have tried 0.25 seconds. The remote control of robot is carried out through assigning the file to be operated.

ACTUAL RESULTS

The editor of a two-legged robot of Robovie-X and that of Robovie-i [3] were used in order to implement the programs. Several programs were played at science-shows and as attraction of some festivals.

CONCLUSIONS

There is similarity between brain mechanism [4] and operation of computer. The intelligence can be expressed by layered network of representatives. Effectiveness of the concept was confirmed by implementation of two-legged walking robot. The concept of representatives is available for programming of any of humanoid.

REFERENCES

1. Karasawa S., 2012. " Forming of intelligence that is intermittently opened to the real world". How a newborn baby acquires primitive intelligence, Seeing and Perceiving, Vol. 25 Supplement 57, 13th International. Multisensory Research Forum, Univ. Oxford, UK.
2. Brooks R. A., 1986. "A robust layered control system for a mobile robot". IEEE Journal of robotics and automation, RA-2, 14 -23.
3. ATR and V-stone Co., 2009. "Robovie Maker2". Editor for the software of small CPU board VS-RC0033.
4. Nicholls J. G., Martin A.R., Wallace B. G., 1997. "From neuron to brain". A cellular and Molecular Approach to the Function of the Nervous System, 3rd edition, Sinauer Associates, Inc. U.S.A.