Exam

EXAM Monday 14 May

Revisions:
Skype session on Wednesday 9 May
from 6pm to 9pm (shauert).

Alix session in Queen's downstairs entry hall on Monday 7 May from 3pm to 6pm.

Topics

Neural Systems:

1) Know about important brain initiatives in the world.
2) Understand parallels between biological and artificial neural networks
3) Compute the outcome of an ANN given the weights, structure, and input.
4) Know how to choose the correct neural architecture for a given problem.
5) Apply back-propagation for learning.
6) Name application areas for artificial neural networks.
7) Discuss limitations of the technology.

Cellular systems:

1) Implement CA rules in a simulator to visualise the outcome.
2) Design your own CA rules - highlighting the neighbourhood used.
3) Know how to qualitatively classify CAs (uniform final state, simple stable or periodic final state, chaotic,complex…) .
4) Explain what the universality of CAs means.
5) List the limitation of CAs with respect to other modelling tools.

Artificial evolution:

1) Know key principles in natural evolution.
2) Understand the parallel between natural and artificial evolution.
3) Design your own Genetic Algorithm (population, genotype, phenotype, selection, mutation, crossover, fitness).
4) List applications of artificial evolution.

Bio-inspired robotics:
1) Design a CPG for basic robot control.
2) Provide examples of robots where CPGs were used and how.
3) Explain the philosophy behind behaviour-based robotics.
4) Implement basic Braitenberg vehicles.
5) Design a subsumption-based controller for a robot. Discuss the pros and cons of this architecture when compared to planning-based methods
6) Explain the philosophy behind behaviour-based control.

Evolutionary robotics:
1) Know of examples where evolutionary robotics was used for engineering and biology.
2) Design your own evolutionary algorithm (population, genotype, phenotype, selection, mutation, crossover, fitness).
3) Apply evolution to both the design of a robot brain, and its body.
4) Know of evolutionary conditions that lead to cooperative behaviour.

Embodiment and morphological computation:
1) Provide a definition for embodiment and explain why it is important in robotics.
2) Explain what morphological computation is. Provide pros and cons with respect to more classical forms of computation.
3) Give examples of robots that use morphological computation.
4) Theoretically describe the computation performed by a simple system (e.g. limit cycles…).
5) Describe what a Tensegrity robots is.
6) Provide examples of soft robots and their added benefits, disadvantages.

Molecular computing and micro/nano robots:
1) Know of examples of molecular computing.
2) Know the pros and cons of molecular computing compared to traditional computing.
3) Know the pros and cons of DNA memory compared to traditional memory.
4) Know the basic mechanisms to produce DNA origami.
5) Provide examples and applications of DNA computing and machines.
6) Write out Chemical Reaction Networks.
7) Know how to use a chemical computer if given the rules (e.g. Maya computer).

Artificial creativity:
1) Give examples where AI was used to enhance creativity.

Swarm robotics:
1) Understand the principles behind swarm intelligence.
2) Know the basic rules for ACO, PSO, Flocking, Clustering, Decision Making.
3) Cite a couple examples of robot swarm demonstrations.
4) Give examples of how to design swarm algorithms.

Startup pitches:
1) Know which startups were pitched.

General:
Discuss ethical, societal, and legal issues around the use of bio-inspired AI.