# Coursework 2
# (now on Vision)

# Coursework 2

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- You choose between two coursework variants
- It is recommended you do Variant 1:
  - Implement a basic genetic algorithm (GA)
  - Implement a basic version of PSO
  - Compare them using some benchmark problems
  - Write a 3 page report which discusses the results and shows some understanding of GAs and PSO

# Coursework 2



- However, you can do Variant 2 if you prefer
  - This is designed for non-programmers
  - Do a literature review on comparing optimisers using mathematical benchmark problems
  - Compare GA and PSO using a software tool
  - Write a 5 page report which includes the literature review, the results, and shows some understanding of GAs and PSO

# Variant 1



- The main aim is to give you some experience of implementing and using two popular optimisers
  - You get a lot of marks for just implementing them
  - 60% (for F20BC), 50% (for F21BC)
  - You're only required to implement basic versions, but you can add bells and whistles if you want
  - You can use any sensible language, but should use the same language for both implementations

# Variant 1

- The second aim is to give you some idea of how different optimisers perform on different problems
  - You will be using the CEC 2005 benchmarks for this
  - These are standardised mathematical functions where the aim is to find the global optimum
  - You should choose 5 of these
  - Code is available in Java, Python, Matlab and C, so you shouldn't need to implement these functions yourself

# Variant 2



- In Variant 2, you're not asked to implement algorithms, so:
  - I expect you to spend more time studying the literature
  - In particular, you're asked to summarise previous literature on using benchmarks to compare optimisers
  - You're also expected to spend more time on the comparative study (reflected by a larger CW %age) and the discussion of the results

# Comparing Algorithms



- Both variants involve doing experiments to compare GA and PSO
  - It's important that you do this in a fair way, for example using the same population size
  - There's information about this in the coursework spec. **Please make sure you read the spec thoroughly!**
  - You need to do multiple runs, because both algorithms are stochastic

# Comparing Algorithms

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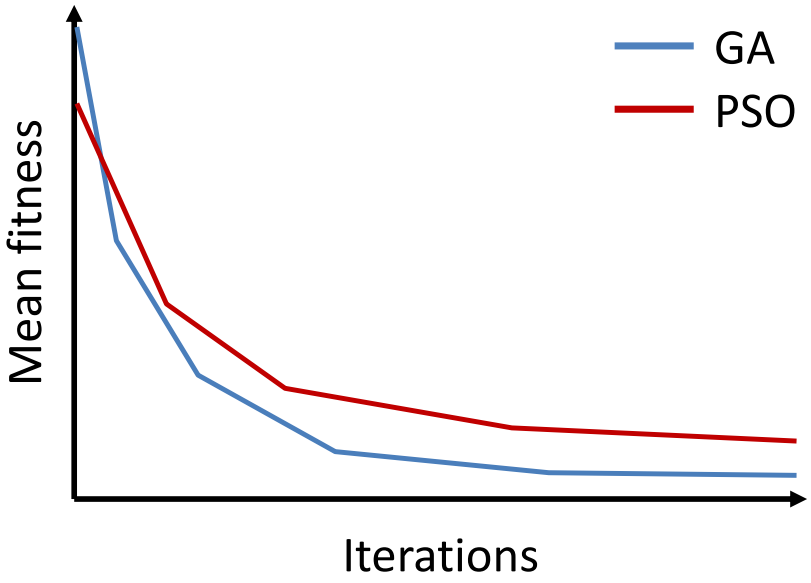
- There are various ways you could present the results of your comparative study:

e.g. mean* fitness of 10 solutions from 10 runs:

| Problem | GA | PSO |
|---|---|---|
| 1 | **0** | 0.5 |
| 2 | -50 | **-100** |
| 3 | **0.04** | 0.05 |
| 4 | 10 | **9** |
| 5 | 100 | **75** |

* You could also add standard deviations or statistical tests

e.g. fitness-iteration plots (average of 10 runs)



# Optimising Hyperparameters



- Both variants also require you to gain some insights into the role of hyperparameters
  - e.g. the effects of varying population size, mutation rate, acceleration coefficients etc.
  - But don't spend too long on this. A few examples and a bit of discussion would suffice.

# F20BC vs F21BC



- Those of you studying F21BC are also asked to relate your observations to the wider literature:
  - e.g. if you observe a particular effect from varying hyperparameters, or see that GA/PSO perform well on particular problems, try to relate this to what other people have reported in the literature

# Clarifications, Questions etc.

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- If anything's not clear, please email me, and I'll send out any relevant clarifications to everyone.