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An AI invention would typically involve

1. A problem statement (what problem is being addressed, and what prior art is relevant)
2. A description of a new or novel technique for addressing the problem
3. Some justification that this new technique advances the state of the art in addressing this problem.

A typical AI problem might be to encounter some external stimulus (speech, vision, data from real-time cameras, etc.) and classify the stimulus by category and/or to do certain actions to carry out a task.

The central issue in many of these problems is creating a mathematical model that maps the stimulus into one or more outputs to achieve the classification/action. This process, called training, is carried out by mathematical processes, often with tens of millions of parameters, leading to one or more measures of how well the invention has solved the problem.

There are many pitfalls in assessing such a program. For example, there is the problem of *overtraining*. This happens when the parameters trained to do excellently on the set of stimuli used to train the invention, but may be deficient when addressing new stimuli. For example, many face recognition algorithms have performed acceptably on Caucasians but have failed miserably when encountering other racial groups.

In assessing an invention, there are several aspects that should be separated.

1. The construction of the mathematical operations to perform the desired action, including the evaluation of correctness (usually called *loss*).
2. The specific parameters in a model that has been trained to carry out the desired action.
3. The methodology by which the program was trained -- this may involve the selection and presentation of stimuli, the mathematical operations used to compute the loss, and the mathematical operations used to optimize the parameters.

Any patent that relies on finding a solution to a mathematical problem is suspect for several reasons:

1. Discoverability. Suppose there is one optimal solution, but three different ways of achieving it. In practice, determining which method did the training can be exceptionally difficult, especially given the number of parameters.
2. Again, because the problems are so large, do you want to allow a patent that differs from another in the way it sets 1% of the parameters? .1%? .0001?
3. There is a lot of evidence that many practical AI problems could have multiple solutions, with different parameters: one speech recognition system might be slightly better at understanding women, another deals with Hispanic accents better, another does better ordering food but not as good at setting the thermostat.

So I would recommend taking a very cautious approach in patenting AI inventions. The "mathematical" part of the invention is already covered by the treatment of algorithms in standard computing. The parameter settings are too numerous for humans to understand, and differences. The training methodology could potentially involve some significant innovations, but separating them from the other two steps is very delicate and should be undertaken with great care.

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