Key contributions
The paper proposed a search method for neural network architectures that can perform tasks without weight training. The idea was based on observations of animals that have certain abilities at birth. The search was done by using a single shared weight param for every network connection and evaluating the network on a wide range. This searches for architecture with strong inductive biases and the paper shows neural networks found that can perform tasks effectively although not all efficiently.

Strengths
They showed weight agnostic neural networks achieve much higher than random accuracy on MNIST using random weights and that it can perform reinforcement tasks without weight training. In neural architecture search, the goal was to produce architectures that outperform those by humans once trained. This paper calls attention to the innate structure of networks while before it was all focused on training weights.

Weaknesses
The networks are optimized to perform well over a single weight so it is highly sensitive to the initial weight. The WANNs fail when individual weight values are assigned randomly, so the weight still has an effect. The search method proposed in the paper is also constricted to the space of neural architectures that gradient descent is able to train. Models that rely on discrete components or utilize adaptive computation mechanisms are challenging.

My Takeaways

I had participated in research of evolutionary based automated neural network search where genes were network components/layers. Our research used survival of the fittest and genetics to search space of neural networks which reminded me of the at birth concept in the paper. If my evolutionary NAS was initiated with weight agnostic neural networks it would be interesting to see how networks with strong inductive biases evolve as the strong genes (components) are passed on.