# Proposal

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## Introduction

Machine Learning models/ neural networks often are trained for only very specific tasks: playing poker, protein folding, driving a car. While these tasks have many different sub-problems, the end goal is to solve a very distinct task. When neural networks are trained on new tasks, they will forget their old task, called catastrophic forgetting (Kirkpatrick et al. 2017). However, real intelligent beings can learn multiple tasks and excel at each task, they don't forget previous tasks. Therefore its an important goal for neural networks to be able to solve multiple tasks.

## Specific Aims

The goal of this paper is train a multitask/ "general"card solving neural network. The goal is train a neural network to play both blackjack and 2-card poker and then compare the results to neural networks trained only to play blackjack and poker, each. The paper is inspired by Open AI's transformer neural network, Whisper, an automatic speech recognition (ASR) system. The paper found that "for sufficiently large models there is no drawback and even benefits to joint multilingual and multitask training." (Alec Radford 2022)

## Data

The python implementations of 2-card poker and blackjack will be used train/ test the neural networks. All the data will generated for the paper will be from this setup.

## Research Design and Methods

Overall, three neural networks will be trained. Three deep reinforcement learning TensorFlow models will be created using the Keras API. The general neural network will be trained using method known as "Elastic Weight Consolidation" (Kirkpatrick et al. 2017). Then the models will be compared in two ways. In the first way, the models will separately play the same game and then results for compared using Fisher's test. Secondly, the networks will compete against each and then test the head-to-head record using a binomial test.

## Discussion

I believe the general card model will perform better than each individual model. In other multitask/ "general" neural networks papers, often the multitask outperform the models trained individuality. For example, an agent trained using EWC to play Atari games performed better the baseline, Deep Q-Network (DQN) (Kirkpatrick et al. 2017).

## Conclusion

To reach true intelligence, neural networks have to be able to solve many tasks. In this paper a general neural network will created using EWC, to overcome catastrophic forgetting , to hopefully outperform individually trained model.

## References

Alec Radford, Tao Xu, Jong Wook Kim. 2022. "Robust Speech Recognition via Large-Scale Weak Supervision." *OpenAI*. %22https://cdn.openai.com/papers/whisper.pdf%22.

Kirkpatrick, James, Razvan Pascanu, Neil Rabinowitz, Joel Veness, Guillaume Desjardins, Andrei A. Rusu, Kieran Milan, et al. 2017. "Overcoming Catastrophic Forgetting in Neural Networks." *Proceedings of the National Academy of Sciences* 114 (13): 3521–26. https://doi.org/10.1073/pnas.1611835114.