

Multi-Task Learning for Dense Prediction Tasks: A Survey

Overall quality

The paper talks about the importance of multi-task learning over tasks which are handled in isolation. The paper presents multi-task learning first from a network architecture point-of-view, then it examines various optimization methods, exploring the similarities, differences, pros and cons of both the strategies. The content of the paper is very well organized, and it takes a step by step approach to explain the various methods used in multi-task learning. The experiments section provides some interesting and valuable outcomes which opens up discussion for further research.

Critique

There are many optimization aspects in the paper that still remain poorly understood. For example, opposed to recent works, the analysis indicates that avoiding gradient competition between tasks can hurt performance. Furthermore, the study revealed that some task balancing strategies still suffer from shortcomings and highlighted several discrepancies between existing methods. This remains an area to be understood and needs to be tackled. Not much detail is provided about Neural architecture search for other related domains.

Improvements

As the tasks learn shared representations, we need to carefully balance this learning to avoid the prevalence of any one task in network weights. The network weight update can be suboptimal when the task gradients conflict or dominated by one task when its gradient magnitude is much higher with respect to the other tasks.

For multi-task learning to succeed, proper network architecture should be selected. The selection should be done keeping performance in mind.

Future directions and Suggestions

- We can improve upon optimization strategies. For example, avoiding gradient competition between tasks can hurt performance.
- Improvements to select architecture: Success of MTL strongly depends on the use of a proper network architecture. Typically, such architectures are handcrafted by human experts. However, given the size and complexity of the problem, this manual architecture exploration likely exceeds human design abilities. We need to find methods to automate design of neural network architecture.
- We need to make manual architecture selection affordable, scalable and reliable.
- In addition to audio, video, language and robotics, we can explore more domains like health care.

References

<https://arxiv.org/pdf/2004.13379.pdf>