1. Machine Learning & Neural Networks

(a)

i. Due to the influence of the beta factor, the impact of the calculated gradient is small. The change mainly depends on the current momentum, which helps reduce the jitter caused by the current mini-batch, which may be helpful to learning.

ii. The momentum model will get larger updates. We can see the v as a normalization factor. It can make the larger gradient smaller, which helps reduce the jitter caused by the current mini batch.

(b)

i. Assume there are N units in the hidden layer. There are N\*(1-*prop*)units still remain active. So, these active units need to be divided by 1-*prop* to make the expectation of the hidden layer the same.

ii. In the training phase, we use dropout regularization because we don’t want the network to rely too much on some specific units. But in real testing phase, all units are useful and we can’t abandon them.

1. Neural Transition-Based Dependency Parsing

(a)

|  |  |  |  |
| --- | --- | --- | --- |
| Stack | Buffer | New dependency | Transition |
| [ROOT] | [I, parsed, this, sentence, correctly] |  | Initial Configuration |
| [ROOT, I] | [parsed, this, sentence, correctly] |  | SHIFT |
| [ROOT, I, parsed] | [this, sentence, correctly] |  | SHIFT |
| [ROOT, parsed] | [this, sentence, correctly] | parsed🡪I | LEFT-ARC |
| [ROOT, parsed, this] | [sentence, correctly] |  | SHIFT |
| [ROOT, parsed, this, sentence] | [correctly] |  | SHIFT |
| [ROOT, parsed, sentence] | [correctly] | sentence🡪this | LEFT-ARC |
| [ROOT, parsed] | [correctly] | parsed🡪sentence | RIGHT-ARC |
| [ROOT, parsed, correctly] | [] |  | SHIFT |
| [ROOT, parsed] | [] | parsed🡪correctly | RIGHT-ARC |
| [ROOT] | [] | ROOT🡪parsed | RIGHT-ARC |

(b) 2n steps in total. For each word in the sentence, we need to push it in to the stack and pop it from stack, which are two operations.

(f)

i. Error Type: Verb Phrase Attachment Error

Incorrect Dependency: wedding🡪fearing

Correct Dependency: fearing🡪was

ii. Error Type: Coordination Attachment Error

Incorrect Dependency: makes🡪rescue

Correct Dependency: rush🡪rescue

iii. Error Type: Prepositional Phrase Attachment Error

Incorrect Dependency: named🡪Midland

Correct Dependency: guy🡪Midland

iv. Error Type: Modifier Attachment Error

Incorrect Dependency: elements🡪most

Correct Dependency: crucial🡪most