CNNs

Except in weird ambiguous cases, it’s usually not like “oh, I see that’s a dog now, but I had to look somewhere outside the dog to know that.”  So you can start with small things and move upward, hierarchically: “ah, that’s an edge –> ah, that’s an oblong thing made of edges –> ah, that’s a dog’s nose –> ah, that’s a dog’s head –> ah, that’s a dog.”  Each thing is defined only by the things inside it (which are, by definition, smaller).

With text, you can’t do that.  A sentence can have a pronoun at one end whose antecedent is all the way at the other, for example.  There’s no way to safely break a sentence down into units that can definitely be understood on their own, and only then linked up to one another.  So locality is out.  (Well, okay, plenty of people do use CNNs on text, including me.  They work well enough for plenty of purposes.  But one can do better)

RNNs

When the input is textual, this feels a lot like “reading” – the RNN processes the the first word, writes down a summary of what it’s gleaned so far, then processes the second word in light of the summary, updates the summary, processes the third word in light of the summary, updates the summary, etc.

Usually people use RNN architectures (LSTMs/GRUs) that can learn about when to “forget” information (remove it from the summary) vs. when to pass it along.  This lets them do things like writing down “there’s this pronoun I still don’t have a referent for,” and pass that along across a potentially long range until it finds a fitting antecedent.

This is problematic when, for example, words at the start of a sentence can only be understood in light of words that come much later.  The RNN can understand *later* words in light of *earlier* ones (that’s the whole idea), but not the reverse.

An RNN has to bumble its way through this sentence, writing things down on a scratchpad of limited size, opportunistically omitting some details and hoping they won’t turn out to matter.  *“Okay, gotta remember that this ‘it’ needs an antecedent [scribbles] … I have limited room, I can probably get away with a hazy sense of something about beauty and bicycles, oh jeez here’s an ‘and though’ clause, uh, what’s this about pigs? I’ve got [checks notes] ‘pretty bicycle past tense,’ no pigs there, I’ll add ‘pigs’ and hope it’s explained later… what was the ‘though’ about, anyway? oh dear…” -Funny*