Notes on the DSPy Model

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DSPy framework treats LMs as abstract devices for text generation, and optimizes their usage in arbitrary computation graphs. DSPy programs are written in Python – each program takes a task input (e.g. a question to answer or a paper to summarize) and returns the output (e.g. an answer or a summary) after series of steps. DSPy presents three abstractions toward automatic optimization – *signatures*, *modules,* and *teleprompters*.

*Signatures* abstract the input/output behavior of a module. *Modules* replace existing hand-prompting techniques and can be composed in arbitrary pipelines. *Teleprompters* optimize all modules present in a pipeline to maximize a metric.

Details on *Signatures*

Instead of free form string prompts, DSPy programs use natural language *signatures* to assign work to the LM.

A DSPy signature is a *natural-language typed* declaration of a function: a short declarative spec that tells DSPy **what** a text transformation needs to do (e.g. *“consume questions and return answers”*), rather than **how** a specific LM should be prompted to implement that behavior. More formally, a DSPy signature is a tuple of *input fields* and *output fields* (and an optional *instruction*). A field consists of *field name* and optional *field metadata*.

In typical usage, the roles of the fields are inferred by DSPy as a function of field names. For instance, the DSPy compiler will use in-context learning to interpret question differently from answer and will iteratively refine its usage of these fields.

Signatures offer two benefits over prompts – they can be compiled into self-improving and pipeline-adaptive prompts or finetunes. This is primarily done by bootstrapping useful demonstrating examples for each signature. Additionally, signatures absorb the structured formatting and parsing logic to reduce brittle string manipulation in user programs.

In practice, DSPy signatures are expressed with a shorthand notation like question -> answer, as shown in the example below:

1 qa = dspy.Predict(“question -> answer”)

2 qa(question=”Where is Guarani spoken?”)

# out: Prediction(answer=’Guarani is spoken mainly in South America.’)