Learning logic programs by discovering higher-order abstractions

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Program Synthesis

Input	Output
ijcai	IJCAI
program	PROGRAM

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First-order program

```
f(Input,Output) ←
   empty(Input),empty(Output).
f(Input,Output) ←
    head(Input,Head1), tail(Input,Tail1),
    head(Output,Head2), tail(Output,Tail2),
    uppercase(Head1,Head2), f(Tail1,Tail2).
```

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First-order program

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f(Input,Output) ←
   empty(Input),empty(Output).
f(Input,Output) ←
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    head(Output,Head2), tail(Output,Tail2),
    uppercase(Head1,Head2), f(Tail1,Tail2).
```

Second-order program

```
f(Input,Output) ←
   map(uppercase,Input,Output).
```

Challenge

Automatically discover abstractions such as *map*, *fold*, *filter*, ...

Our approach

We introduce an approach that automatically discovers useful higher-order abstractions.

Our approach

We implement this approach as a constraint optimisation problem, where we compress a logic program.

1. abstract stage: we build higher-order abstractions
2. compress stage: we search for a subset of the abstractions that compresses the program

Our results

We can rediscover usual abstractions such as *map*, *filter*, and *fold*.

Our results

Discovering abstractions can:

- improve predictive accuracies by **27%**
- reduce learning times by **47%**

Our results

Discovered abstractions can be transferred to different domains

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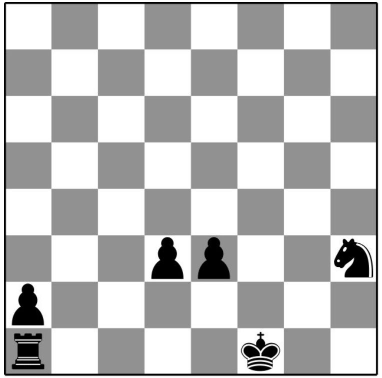

Thank you!

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