

Discussion 4: Experiment: Comparison to SVMRanker

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Experiment Result

Test cases are grabbed from SV-COMP. Number of cases: 134.

	2-Multiphase	5-Multiphase	SVMRanker	LassoRanker
FINITE	39	42	30	24
INFINITE	34	34	34	37
UNKNOWN	61	58	70	73

Our algorithm can solve more cases than SVMRanker and LassoRanker.

Time Result

Specifying Cases

- ▶ Multiphase with depth 2 solved & SVMRanker not solved:
2, 51, 66, 67, 72, 73, 144, 152, 161
- ▶ SVMRanker solved & Multiphase not solved:
159
- ▶ Multiphase with depth 5 solved:
7, 155, 126
- ▶ Advantage of Multiphase with depth 5 to LassoRanker:
1, 7, 58, 66, 67, 83, 144, 148, 149, 150, 151, 152, 153, 155, 156, 157
158, 160, 161, 163, 164, 166, 167, 171
- ▶ LassoRanker's advantage to Multiphase:
Termination: 146, 147, 129, 74, 71, 15
Non-termination: 85, 25, 26

Multiphase to SVMRanker

We solve two types of new loops:

- Decreased by a variable: 2, 51, 72, 73, 144, 152, 161

```
procedure main() returns () {  
  var x1, x2: int;  
  while (x1 >= 0) {  
    x1 := x1 + x2;  
    x2 := x2 - 1;  
  }  
}
```

- Flipping between negative and positive: 66, 67

```
procedure main() returns ()  
{  
  var q, z, y: real;  
  while (q >= 0.0) {  
    q := q + z - y - 1.0;  
    y := 0.0 - y;  
    z := 0.0 - z;  
  }  
}
```

SVMRanker to Multiphase

159.bpl

```
procedure main() returns () {  
  ....var x0, x1: real;  
  ....while (1.0 <= x0 && x1 * x1 + 2.0 * x0 <= 3.0 * x1) {  
    ....x0, x1 := 1.0 + 1.0 / (x0 * x0), 0.0 - x1 * x0 - 3.0 * x1 + x1 * x1 + 1.0;  
    ....}  
  }  
}
```

Reason: we use the linear templates.

Multiphase with Depth 5

7,126

```
procedure main() returns (a: int, b: int, c: int, d: int)
{
  while (a >= 0 || c >= 0) {
    a := a + b;
    b := b + c;
    c := c + d;
    d := d - 1;
  }
}
```

Continue

155

```
procedure main() returns () {  
  ... var x0, x1: real;  
  ... while (x1*x1 >= x0*x0 - x0 + 1.0) {  
    ... | ... x0, x1 := x0*x0 + x1 + 1.0, -x1+1.0;  
    ... }  
}
```

```
-----LEARNING MULTIPHASE SUMMARY-----  
MULTIPHASE DEPTH: 3  
LEARNING RESULT: FINITE  
-----RANKING FUNCTIONS-----  
| - 0.8 * x[0]^1 - 0.4 * x[1]^1 + 3.0 * 1  
| - 0.0246 * x[0]^1 + 0.033 * x[1]^1 + 1.0 * 1  
0.4762 * 1 - 0.0132 * x[1]^1 + 0.4762 * 1  
Time For ../Program_non/155.bpl Is ---> 45915.733000 ms  
  
Program is terminating
```

Not sure whether the result of this case is correct.

Termination: LassoRanker

Termination: 146, 147, 129, 74, 71, 15

- ▶ 146, 147: large scale cases, where the number of variables is 51. Our algorithm goes timeout.
- ▶ 129: Might be the problem of incompatible types or redundant variables. To be investigated later.

```
procedure Waldkirch(c: int) returns (x: int)
{
  var y: int;

  while (x >= -1048) {
    x := x - 1;
  }
}
```

▶ 74

```
procedure main() returns ()
{
  var i, j: int;
  while (i >= 0 || j >= 0) {
    if (i > j) {
      i := i - 1;
    } else {
      j := j - 1;
    }
  }
}
```