

# Using Iterators in SeqVarTools

*Stephanie M. Gogarten*

April 25, 2023

## Contents

1	Introduction . . . . .	1
2	Block iterators. . . . .	1
3	Range iterators . . . . .	3
4	Window iterators . . . . .	4
5	List iterators . . . . .	6

## 1 Introduction

---

Iterators can be used to apply a user function to a *SeqVarData* object. Creating the iterator defines the sets of variants returned on every subsequent call to `iterateFilter`. `iterateFilter` returns TRUE if there are more variants remaining, and FALSE when all variants have been returned.

## 2 Block iterators

---

The simplest type of iterator, a *SeqVarBlockIterator*, returns variants in consecutive blocks.

```
> library(SeqVarTools)
> gds <- seqOpen(seqExampleFileName("gds"))
> seqData <- SeqVarData(gds)
> iterator <- SeqVarBlockIterator(seqData, variantBlock=500)

# of selected variants: 500

> var.info <- list(variantInfo(iterator))
> i <- 2
> while(iterateFilter(iterator)) {
+   var.info[[i]] <- variantInfo(iterator)
```

## Using Iterators in SeqVarTools

```
+   i <- i + 1
+ }

# of selected variants: 500
# of selected variants: 348
# of selected variants: 0

> lapply(var.info, head)

[[1]]
  variant.id chr      pos ref alt
1          1  1 1105366  T  C
2          2  1 1105411  G  A
3          3  1 1110294  G  A
4          4  1 3537996  T  C
5          5  1 3538692  G  C
6          6  1 3541597  C  T

[[2]]
  variant.id chr      pos ref alt
1         501  7 48109509  C  T
2         502  7 72486435  G  C
3         503  7 72487157  A  C
4         504  7 72487452  G  A
5         505  7 94872711  G  C
6         506  7 94878932  G  A

[[3]]
  variant.id chr      pos ref alt
1        1001 17 30793147  G  A
2        1002 17 30793151  C  A
3        1003 17 30795794  G  A
4        1004 17 30796109  G  A
5        1005 17 30796359  C  T
6        1006 17 30796663  C  T

> seqResetFilter(seqData)

# of selected samples: 90
# of selected variants: 1,348
```

A filter can be applied before the iterator is created, and only variants included in the filter will be returned by the iterator.

```
> seqSetFilter(seqData, variant.sel=1:100)

# of selected variants: 100
```

## Using Iterators in SeqVarTools

```
> iterator <- SeqVarBlockIterator(seqData, variantBlock=500)
# of selected variants: 100
> var.info <- variantInfo(iterator)
> nrow(var.info)
[1] 100
> iterateFilter(iterator)
# of selected variants: 0
[1] FALSE
> seqResetFilter(seqData)
# of selected samples: 90
# of selected variants: 1,348
```

### 3 Range iterators

---

A *GRanges* object can be used to create a *SeqVarRangeIterator*, where every iteration returns the next range.

```
> library(GenomicRanges)
> gr <- GRanges(seqnames=rep(1,3),
+               ranges=IRanges(start=c(1e6, 2e6, 3e6), width=1e6))
> iterator <- SeqVarRangeIterator(seqData, variantRanges=gr)
# of selected variants: 3
> var.info <- list(variantInfo(iterator))
> i <- 2
> while(iterateFilter(iterator)) {
+   var.info[[i]] <- variantInfo(iterator)
+   i <- i + 1
+ }
# of selected variants: 0
# of selected variants: 4
# of selected variants: 0
> lapply(var.info, head)
[[1]]
  variant.id chr    pos ref alt
1          1  1 1105366  T   C
2          2  1 1105411  G   A
3          3  1 1110294  G   A
```

## Using Iterators in SeqVarTools

```
[[2]]
[1] variant.id chr      pos
<0 rows> (or 0-length row.names)

[[3]]
  variant.id chr    pos ref alt
1         4   1 3537996  T   C
2         5   1 3538692  G   C
3         6   1 3541597  C   T
4         7   1 3541652  G   A

> seqResetFilter(seqData)

# of selected samples: 90
# of selected variants: 1,348
```

## 4 Window iterators

---

Window iterators (*SeqVarWindowIterator*) are a special class of range iterators. When the object is created, the ranges are generated automatically with a specified width and step size, covering the entire genome.

```
> seqSetFilterChrom(seqData, include="22")

# of selected variants: 23

> iterator <- SeqVarWindowIterator(seqData, windowSize=10000,
+                                 windowShift=5000)

# of selected variants: 2

> var.info <- list(variantInfo(iterator))
> i <- 2
> while(iterateFilter(iterator)) {
+   var.info[[i]] <- variantInfo(iterator)
+   i <- i + 1
+ }

# of selected variants: 3
# of selected variants: 1
# of selected variants: 1
# of selected variants: 2
# of selected variants: 4
# of selected variants: 1
# of selected variants: 2
# of selected variants: 1
# of selected variants: 2
```

## Using Iterators in SeqVarTools

```
# of selected variants: 1
# of selected variants: 1
# of selected variants: 4
# of selected variants: 1
# of selected variants: 0

> lapply(var.info, head)

[[1]]
  variant.id chr      pos ref alt
1         1326 22 16042444  C   G
2         1327 22 16042793  A   G

[[2]]
  variant.id chr      pos ref alt
1         1326 22 16042444  C   G
2         1327 22 16042793  A   G
3         1328 22 16049306  T   C

[[3]]
  variant.id chr      pos ref alt
1         1328 22 16049306  T   C

[[4]]
  variant.id chr      pos ref alt
1         1329 22 17729354  G   A

[[5]]
  variant.id chr      pos ref alt
1         1330 22 18338811  C   T
2         1331 22 18338829  G   A

[[6]]
  variant.id chr      pos ref alt
1         1332 22 18348971  G   A
2         1333 22 18349075  A   G
3         1334 22 18349106  A   G
4         1335 22 18349495  G   T

[[7]]
  variant.id chr      pos ref alt
1         1336 22 20328280  G   A

[[8]]
  variant.id chr      pos ref alt
1         1337 22 32000584  G   A
```

## Using Iterators in SeqVarTools

```
2      1338  22 32003125  C T,AT

[[9]]
  variant.id chr      pos ref alt
1      1339  22 32330460  G  A

[[10]]
  variant.id chr      pos ref alt
1      1340  22 38747766  A  G
2      1341  22 38747889  G  A

[[11]]
  variant.id chr      pos ref alt
1      1342  22 43657667  G  A

[[12]]
  variant.id chr      pos ref alt
1      1343  22 43670607  C  A

[[13]]
  variant.id chr      pos ref alt
1      1344  22 43690908  G  A
2      1345  22 43690970  C  T
3      1346  22 43691009  C  T
4      1347  22 43691073  G  A

[[14]]
  variant.id chr      pos ref alt
1      1348  22 48958933  A  G

> seqResetFilter(seqData)

# of selected samples: 90
# of selected variants: 1,348
```

## 5 List iterators

A *SeqVarListIterator* can be used to specify particular variants to include in each iteration. The input is a *GRangesList*, and each list element defines an iteration set.

```
> gr <- GRangesList(
+   GRanges(seqnames=rep(22,2),
+           ranges=IRanges(start=c(16e6, 17e6), width=1e6)),
+   GRanges(seqnames=rep(22,2),
+           ranges=IRanges(start=c(18e6, 20e6), width=1e6)))
```

## Using Iterators in SeqVarTools

```
> iterator <- SeqVarListIterator(seqData, variantRanges=gr)
# of selected variants: 4

> var.info <- list(variantInfo(iterator))
> i <- 2
> while(iterateFilter(iterator)) {
+   var.info[[i]] <- variantInfo(iterator)
+   i <- i + 1
+ }

# of selected variants: 7
# of selected variants: 0

> lapply(var.info, head)

[[1]]
  variant.id chr      pos ref alt
1      1326  22 16042444  C   G
2      1327  22 16042793  A   G
3      1328  22 16049306  T   C
4      1329  22 17729354  G   A

[[2]]
  variant.id chr      pos ref alt
1      1330  22 18338811  C   T
2      1331  22 18338829  G   A
3      1332  22 18348971  G   A
4      1333  22 18349075  A   G
5      1334  22 18349106  A   G
6      1335  22 18349495  G   T
```

After the last iteration, any methods used on the iterator object will return 0 variants. The `resetIterator` method can be used to reset an iterator back to the beginning.

```
> variantInfo(iterator)

[1] variant.id chr      pos
<0 rows> (or 0-length row.names)

> resetIterator(iterator)

# of selected variants: 4

> variantInfo(iterator)

  variant.id chr      pos ref alt
1      1326  22 16042444  C   G
2      1327  22 16042793  A   G
3      1328  22 16049306  T   C
```

## Using Iterators in SeqVarTools

```
4      1329  22 17729354  G  A
```

```
> seqClose(gds)
```