speed_comparison.R

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```r
suppressPackageStartupMessages(library(inlabru))
suppressPackageStartupMessages(library(ggplot2))
suppressPackageStartupMessages(library(patchwork))
suppressPackageStartupMessages(library(INLA))
suppressPackageStartupMessages(library(fmesher))

#### Mesh creation ####

# Some seed points

set.seed(12345L)
loc <- matrix(rnorm(500), 250, 2)

# Basic case

extend <- list(offset = 1)
refine <- list(max.edge = 1)

fmesher_INLA <- inla.mesh.create(loc = loc, extend = extend, refine = refine)
fmesher_Rcpp <- fm_rcdt_2d_inla(loc = loc, extend = extend, refine = refine)
(ggplot() +
  gg(fmesher_INLA) +
  ggtitle(paste0("fmesher/INLA: nV =  ", fmesher_INLA$n)) |
  ggplot() +
    gg(fmesher_Rcpp) +
    ggtitle(paste0("fmesher/Rcpp: nV =  ", fmesher_Rcpp$n)))
```
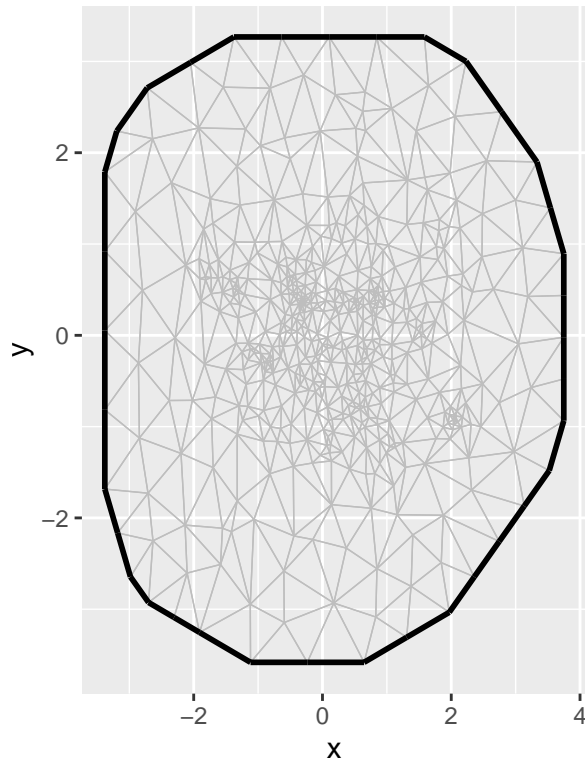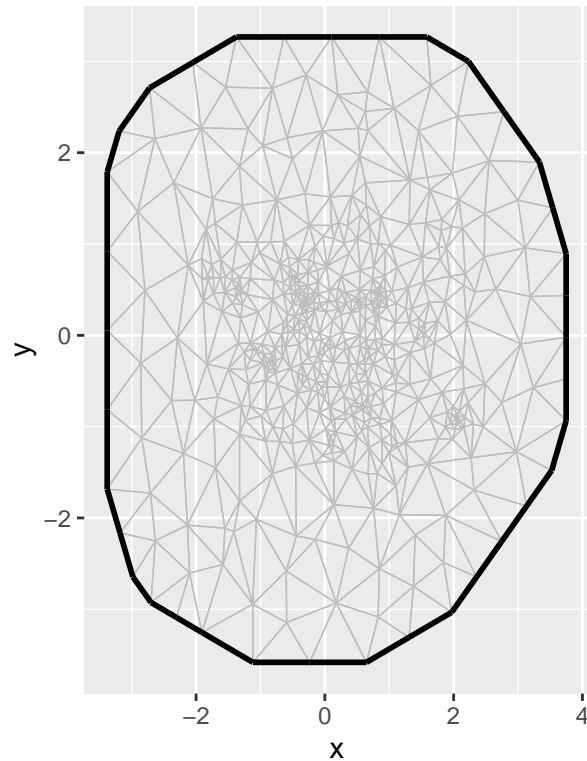
fmesher/INLA: nV = 526   fmesher/Rcpp: nV = 526

```r
bench::mark(
  INLA = inla.mesh.create(loc = loc, extend = extend, refine = refine),
  Rcpp = fm_rcdt_2d_inla(loc = loc, extend = extend, refine = refine),
  check = FALSE
)
```

```
## # A tibble: 2 x 6
##   expression      min   median `itr/sec` mem_alloc `gc/sec`
##   <bch:expr> <bch:tm> <bch:tm>     <dbl> <bch:byt>    <dbl>
## 1 INLA        65.22ms    85.2ms      12.0        NA        0
## 2 Rcpp         3.37ms    3.69ms     257.         NA     2.03
```
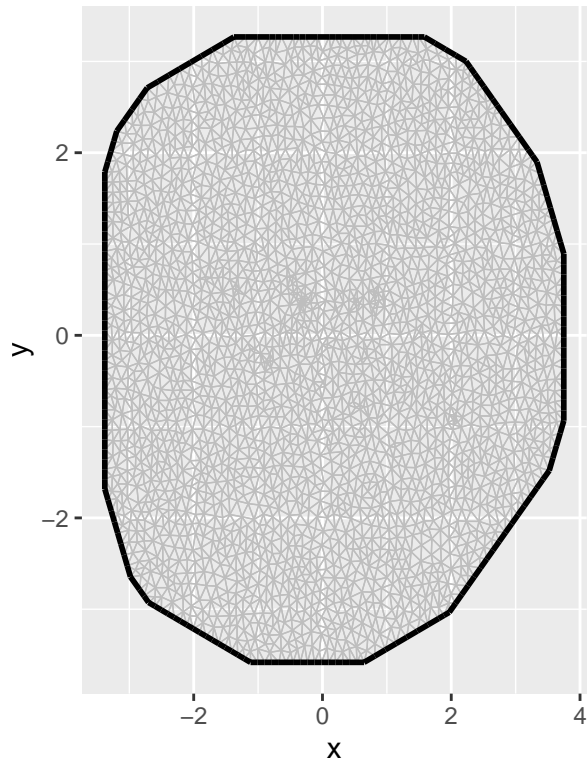
```r
# Basic case with more triangles

extend <- list(offset = 1)
refine <- list(max.edge = 0.2)

fmesher_INLA <- inla.mesh.create(loc = loc, extend = extend, refine = refine)
fmesher_Rcpp <- fm_rcdt_2d_inla(loc = loc, extend = extend, refine = refine)
(ggplot() +
  gg(fmesher_INLA) +
  ggtitle(paste0("fmesher/INLA: nV =  ", fmesher_INLA$n)) |
  ggplot() +
    gg(fmesher_Rcpp) +
    ggtitle(paste0("fmesher/Rcpp: nV =  ", fmesher_Rcpp$n)))
```
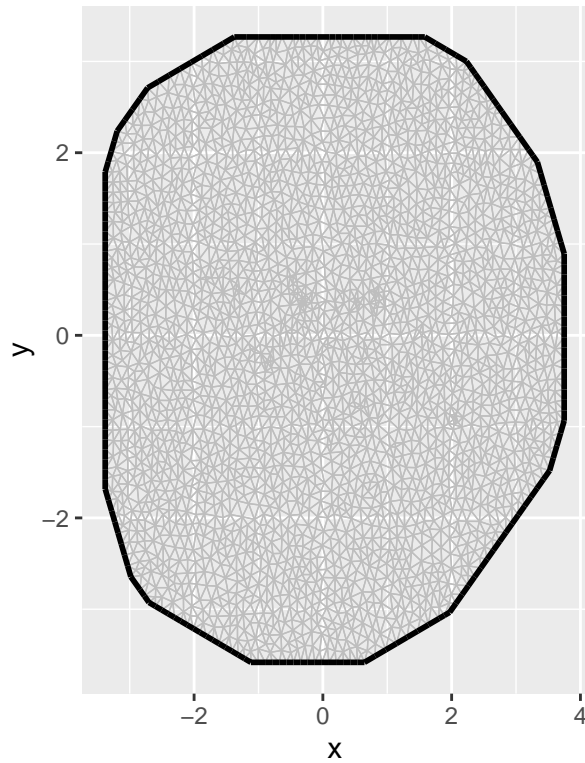
fmesher/INLA: nV = 2787

fmesher/Rcpp: nV = 2787


```r
bench::mark(
  INLA = inla.mesh.create(loc = loc, extend = extend, refine = refine),
  Rcpp = fm_rcdt_2d_inla(loc = loc, extend = extend, refine = refine),
  check = FALSE
)
```

```
## # A tibble: 2 x 6
##   expression      min   median `itr/sec` mem_alloc `gc/sec`
##   <bch:expr> <bch:tm> <bch:tm>     <dbl> <bch:byt>    <dbl>
## 1 INLA         49.4ms   50.4ms      15.8        NA     2.26
## 2 Rcpp         25.5ms     27ms      37.1        NA     2.06
```
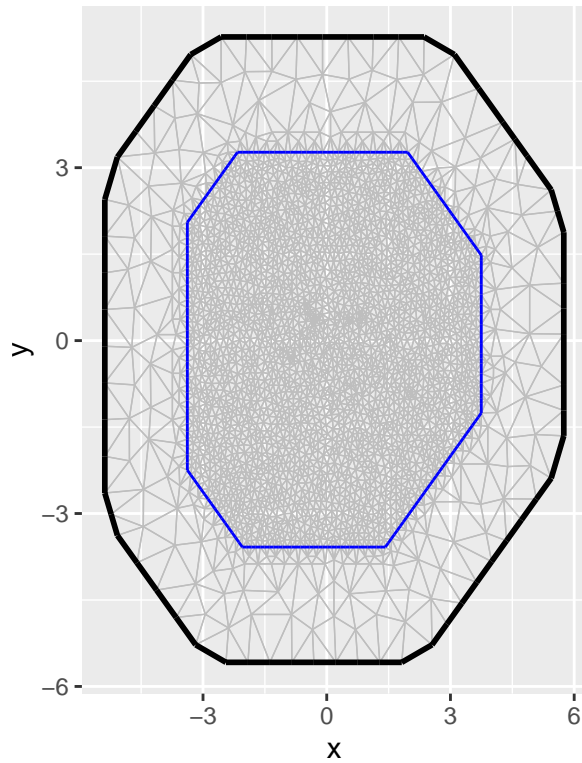
```r
# Two-stage construction:

offset <- c(1, 2)
max.edge <- c(0.2, 1)

fmesher_INLA <- inla.mesh.2d(loc = loc, offset = offset, max.edge = max.edge)
fmesher_Rcpp <- fm_mesh_2d_inla(loc = loc, offset = offset, max.edge = max.edge)
(ggplot() +
  gg(fmesher_INLA) +
  ggtitle(paste0("fmesher/INLA: nV =  ", fmesher_INLA$n)) |
  ggplot() +
    gg(fmesher_Rcpp) +
    ggtitle(paste0("fmesher/Rcpp: nV =  ", fmesher_Rcpp$n)))
```

fmesher/INLA: nV = 3172   fmesher/Rcpp: nV = 3172

```r
bench::mark(
  INLA = inla.mesh.2d(loc = loc, offset = offset, max.edge = max.edge),
  Rcpp = fm_mesh_2d_inla(loc = loc, offset = offset, max.edge = max.edge),
  check = FALSE
)
```

```
## # A tibble: 2 x 6
##   expression      min   median `itr/sec` mem_alloc `gc/sec`
##   <bch:expr> <bch:tm> <bch:tm>     <dbl> <bch:byt>    <dbl>
## 1 INLA         182.8ms  182.8ms      5.47        NA     10.9
## 2 Rcpp          76.2ms   78.3ms     12.7         NA      5.09
```

Basis evaluation

```r
offset <- c(1, 2)
max.edge <- c(0.2, 1)

fmesher_INLA <- inla.mesh.2d(loc = loc, offset = offset, max.edge = max.edge)
fmesher_Rcpp <- fm_mesh_2d_inla(loc = loc, offset = offset, max.edge = max.edge)

set.seed(12345L)
loc_find <- list(
  matrix(rnorm(50), 25, 2),
  matrix(rnorm(500), 250, 2),
  matrix(rnorm(5000), 2500, 2),
  matrix(rnorm(50000), 25000, 2),
  matrix(rnorm(500000), 250000, 2)
)
```
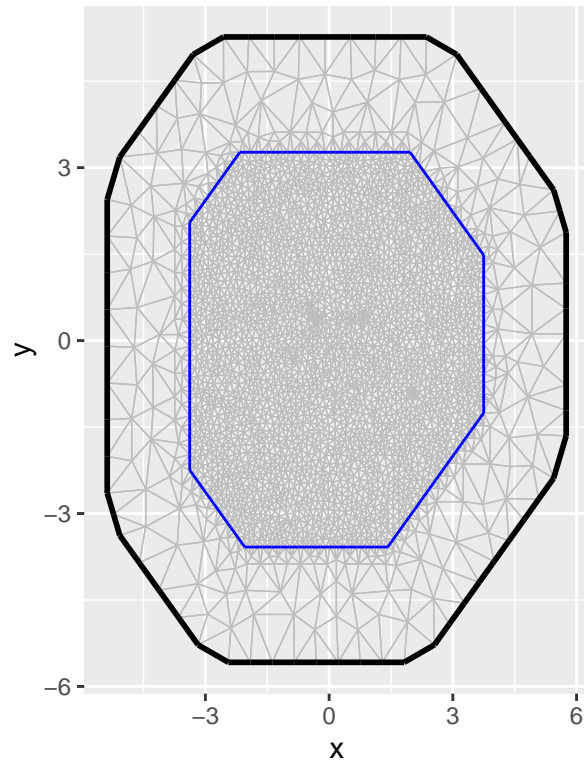
```r
for (lf in loc_find) {
  message(paste0("nrow(locations) = ", nrow(lf)))
  print(bench::mark(
    INLA = inla.mesh.projector(fmesher_INLA, loc = lf)$proj,
    Rcpp = fm_evaluator(fmesher_Rcpp, loc = lf)$proj,
    check = FALSE
  ))
}
```

```
## nrow(locations) = 25

## # A tibble: 2 x 13
##   expression      min median `itr/sec` mem_alloc `gc/sec` n_itr n_gc total_time
##   <bch:expr> <bch:tm> <bch:>     <dbl> <bch:byt>    <dbl> <int> <dbl>   <bch:tm>
## 1 INLA         78.1ms 88.1ms      11.7        NA     2.33     5     1      429ms
## 2 Rcpp         33.6ms 35.6ms      27.9        NA     0       14     0      502ms
## # i 4 more variables: result <list>, memory <list>, time <list>, gc <list>

## nrow(locations) = 250

## # A tibble: 2 x 13
##   expression      min median `itr/sec` mem_alloc `gc/sec` n_itr n_gc total_time
##   <bch:expr> <bch:tm> <bch:>     <dbl> <bch:byt>    <dbl> <int> <dbl>   <bch:tm>
## 1 INLA         75.8ms 79.3ms      11.5        NA     0        6     0      521ms
## 2 Rcpp         33.6ms 35.6ms      28.0        NA     0       14     0      501ms
## # i 4 more variables: result <list>, memory <list>, time <list>, gc <list>

## nrow(locations) = 2500

## # A tibble: 2 x 13
##   expression      min median `itr/sec` mem_alloc `gc/sec` n_itr n_gc total_time
##   <bch:expr> <bch:tm> <bch:>     <dbl> <bch:byt>    <dbl> <int> <dbl>   <bch:tm>
## 1 INLA           79ms 79.8ms      12.4        NA     0        7     0      562ms
## 2 Rcpp         37.6ms 40.4ms      24.9        NA     2.08    12     1      481ms
## # i 4 more variables: result <list>, memory <list>, time <list>, gc <list>

## nrow(locations) = 25000

## # A tibble: 2 x 13
##   expression     min  median `itr/sec` mem_alloc `gc/sec` n_itr n_gc total_time
##   <bch:expr> <bch:t> <bch:t>     <dbl> <bch:byt>    <dbl> <int> <dbl>   <bch:tm>
## 1 INLA        100.9ms 111.1ms     8.84        NA     2.21     4     1      453ms
## 2 Rcpp         61.5ms  63.5ms    14.3        NA     8.58     5     3      350ms
## # i 4 more variables: result <list>, memory <list>, time <list>, gc <list>

## nrow(locations) = 250000

## Warning: Some expressions had a GC in every iteration; so filtering is
## disabled.

## # A tibble: 2 x 13
##   expression      min median `itr/sec` mem_alloc `gc/sec` n_itr n_gc total_time
##   <bch:expr> <bch:tm> <bch:>     <dbl> <bch:byt>    <dbl> <int> <dbl>   <bch:tm>
## 1 INLA          527ms  527ms      1.90        NA     7.59     1     4      527ms
## 2 Rcpp          353ms  412ms      2.42        NA     8.49     2     7      825ms
## # i 4 more variables: result <list>, memory <list>, time <list>, gc <list>
```

profvis

```r
lf <- loc_find[[3]]
system.time({
  for (k in seq_len(100)) {
    INLA <- inla.mesh.projector(fmesher_INLA, loc = lf)$proj
  }
})
```

```
##    user  system elapsed
##   6.775   2.064   8.327
```

```r
system.time({
  for (k in seq_len(100)) {
    Rcpp <- fm_evaluator(fmesher_Rcpp, loc = lf)$proj
  }
})
```

```
##    user  system elapsed
##   4.061   0.010   4.071
```

```r
if (FALSE) {
  profvis::profvis({
    for (k in seq_len(100)) {
      INLA <- inla.mesh.projector(fmesher_INLA, loc = lf)$proj
      Rcpp <- fm_evaluator(fmesher_Rcpp, loc = lf)$proj
    }
  })

  devtools::load_all() # For source
  lf <- loc_find[[3]]
  profvis::profvis({
    for (k in seq_len(100)) {
      Rcpp <- fm_evaluator(fmesher_Rcpp, loc = lf)$proj
    }
  })
}
```