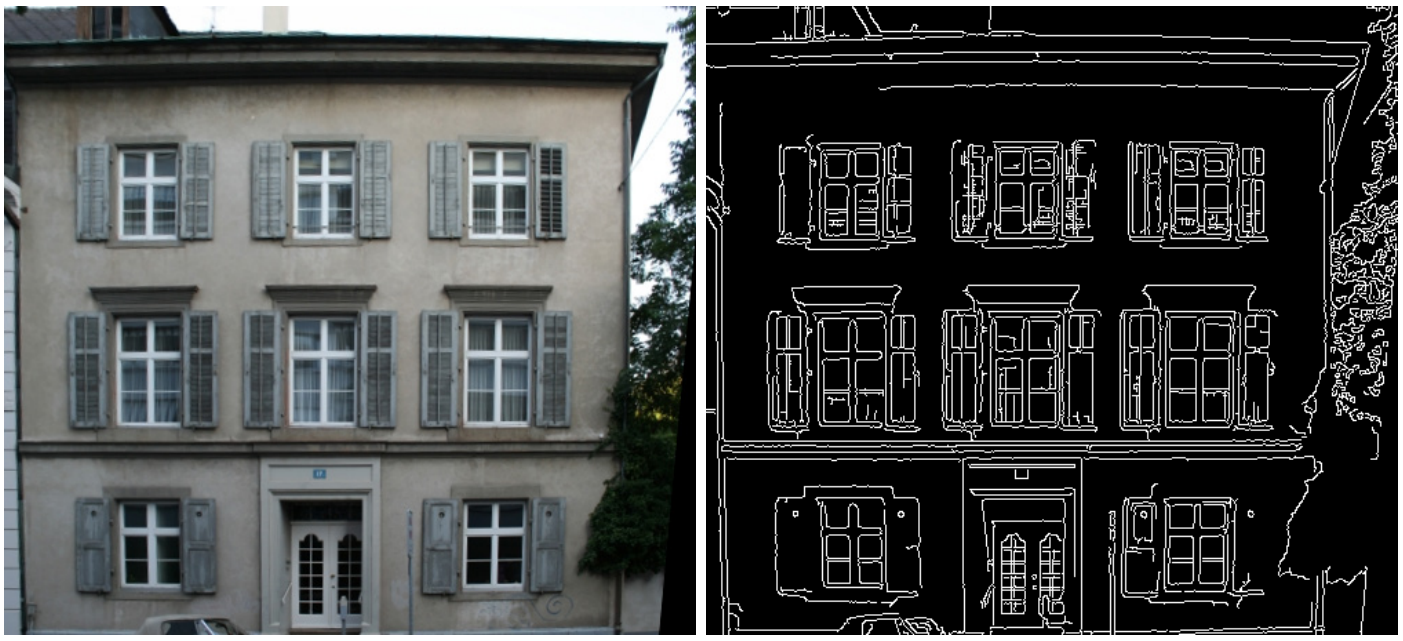
Supplemental Material III

(intermediate results of applying our method to facade images)

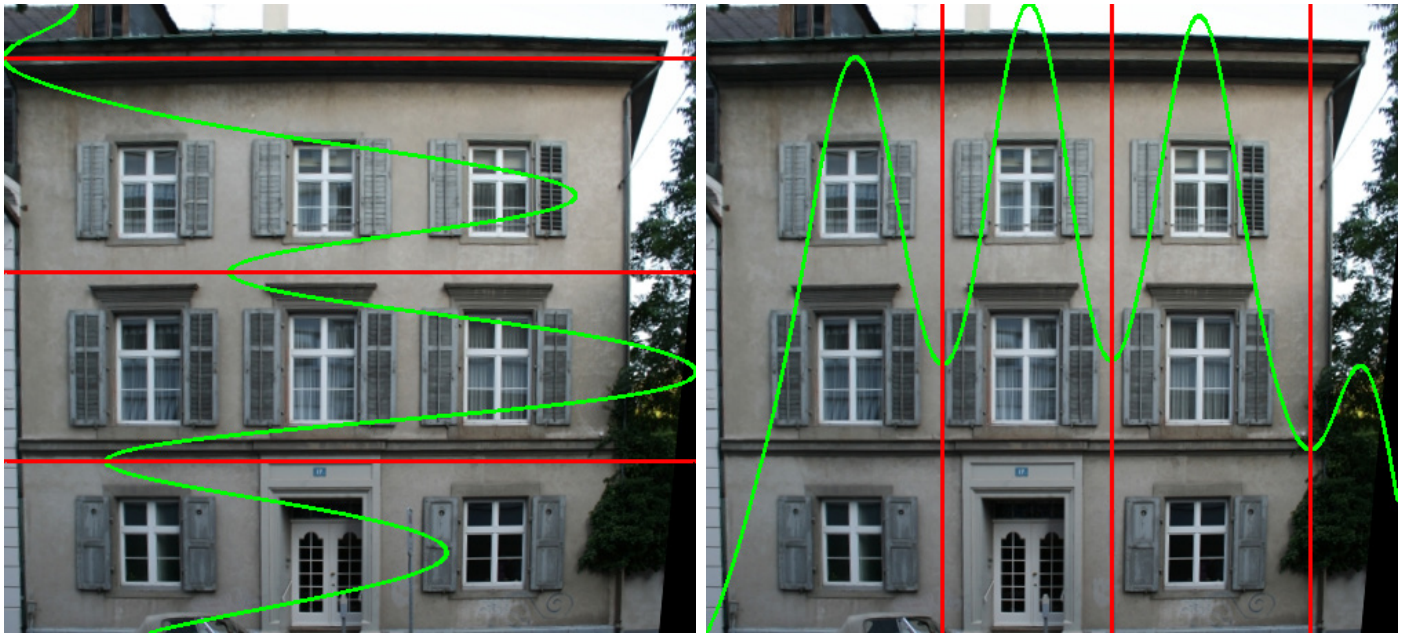
Below we show the intermediate results of some representative facade images, including edge detection, penalty functions in two directions (green lines), initial splitting lines (red lines), iteration of grouping and rectification. For grouped elements, we use the average pixel color to display them.

Example #01



(a) (b)

Figure 1: Input image and detected edges



(a) horizontal (b) vertical

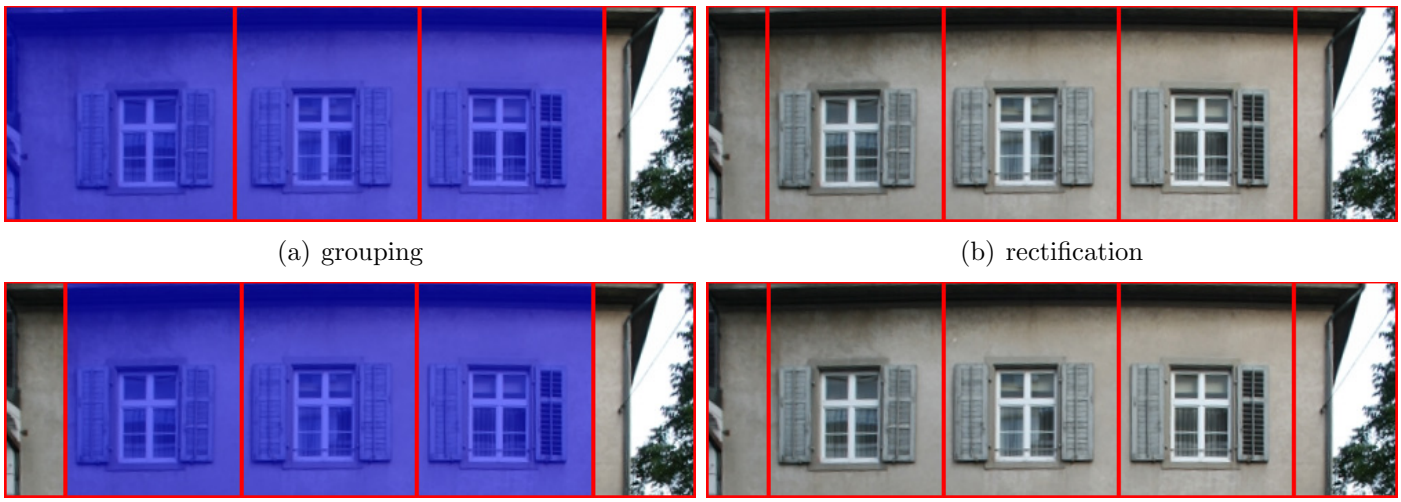
Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 3: Level 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.



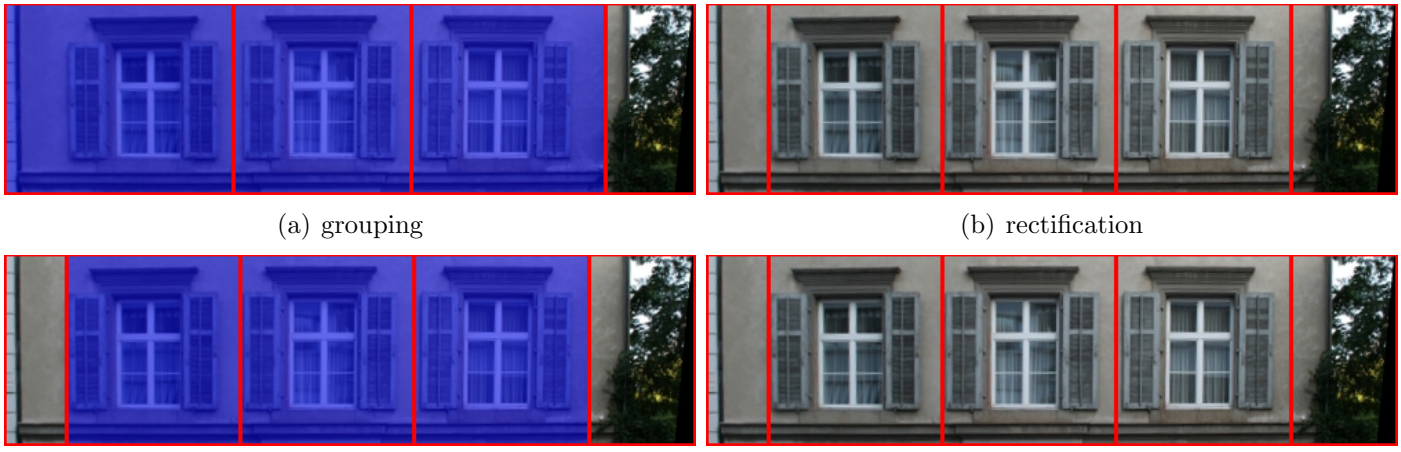
(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.



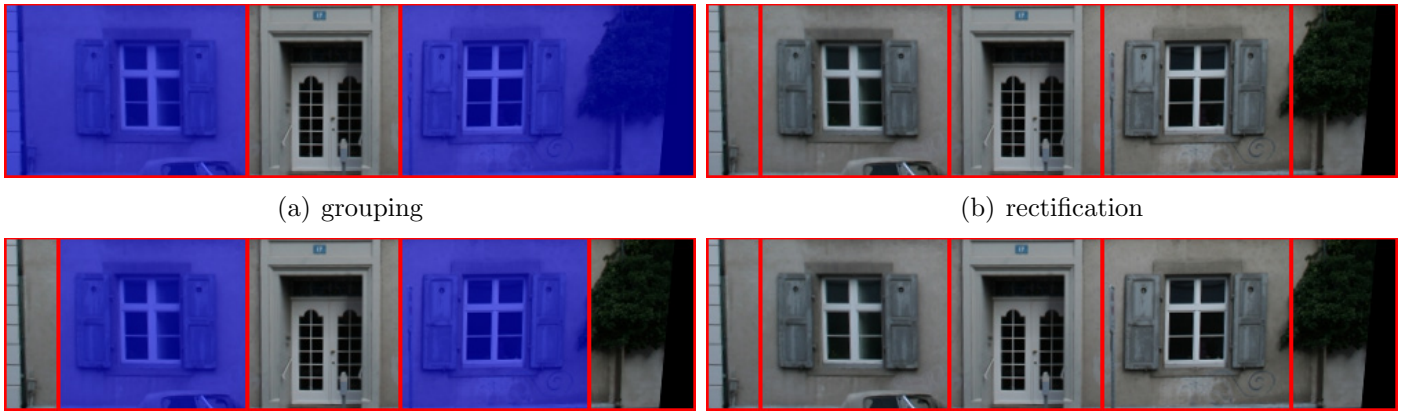
(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 9: Level 2, group 3, iteration of grouping and rectification.

(a) input image

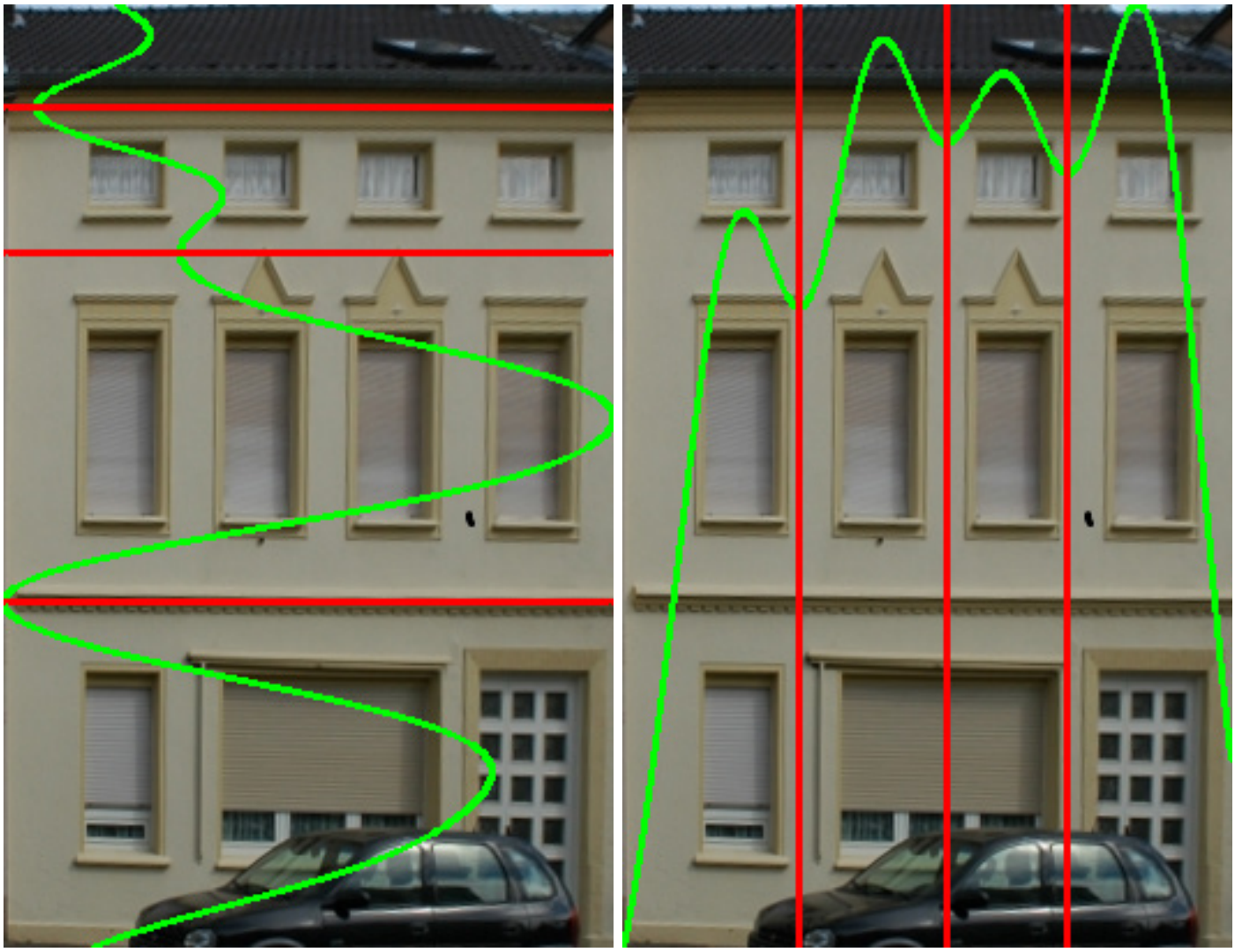
(b) output partition

Figure 10: final result

Example #02

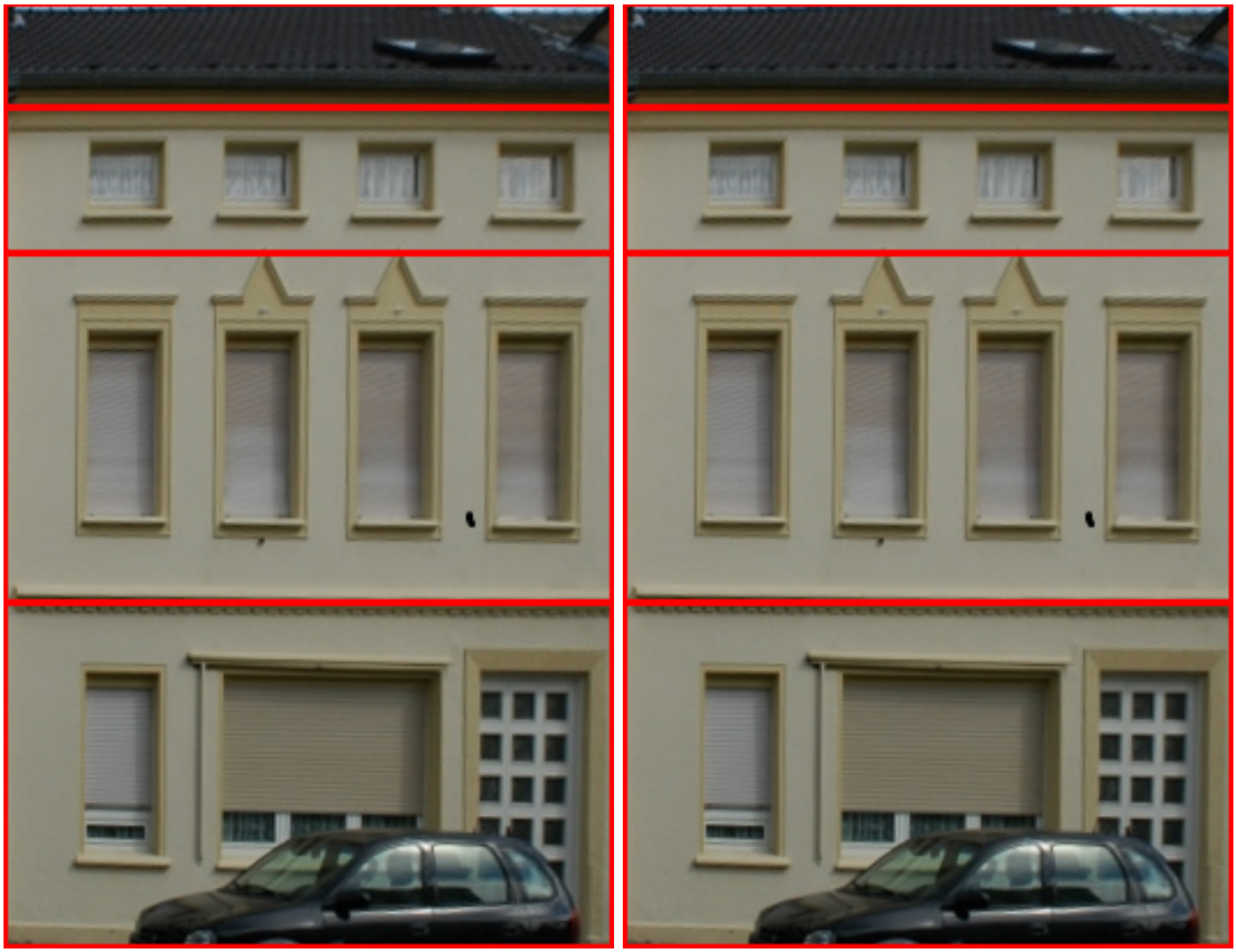
(a) (b)

Figure 1: Input image and detected edges



(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

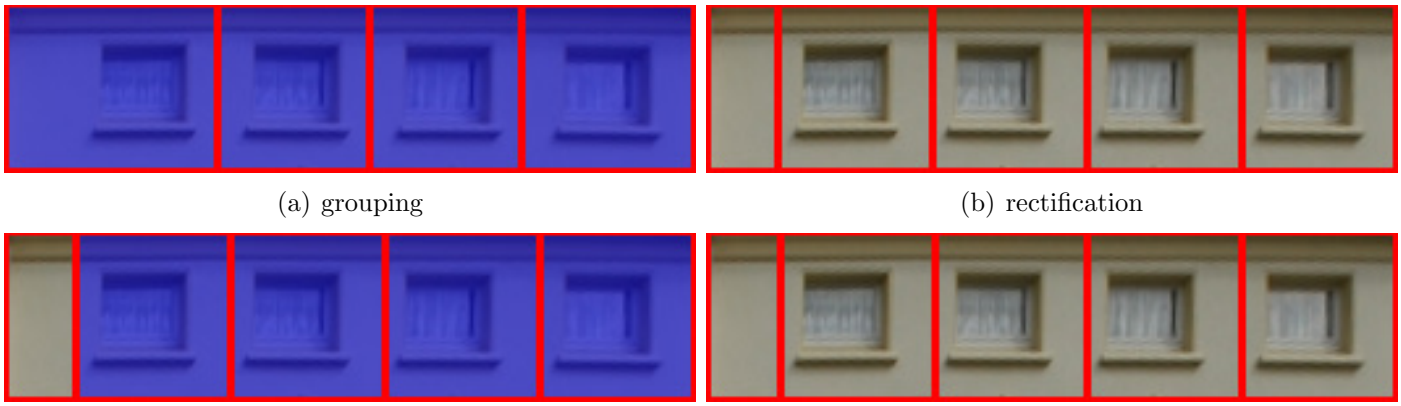


(a) grouping (b) rectification

Figure 3: Level 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

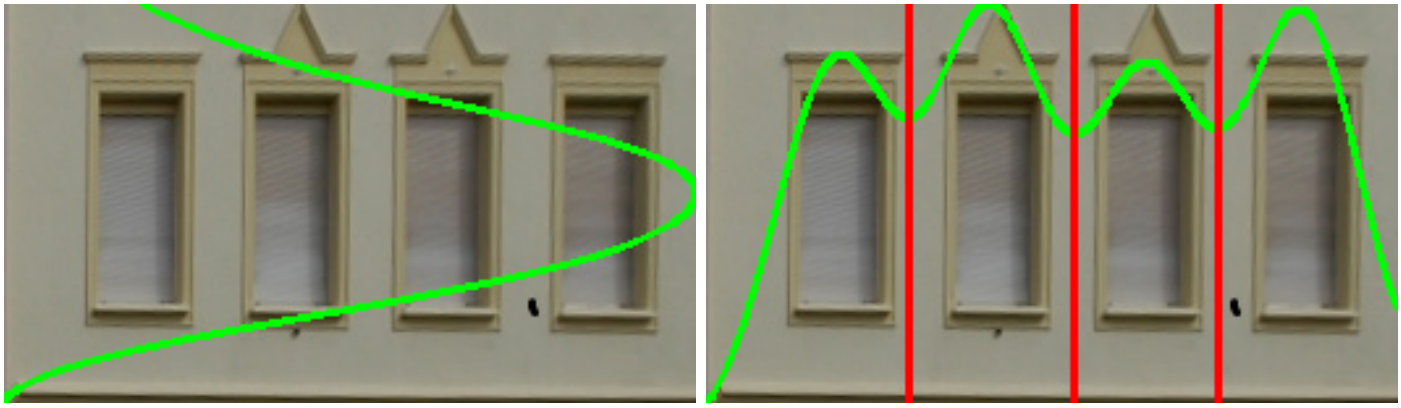
Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

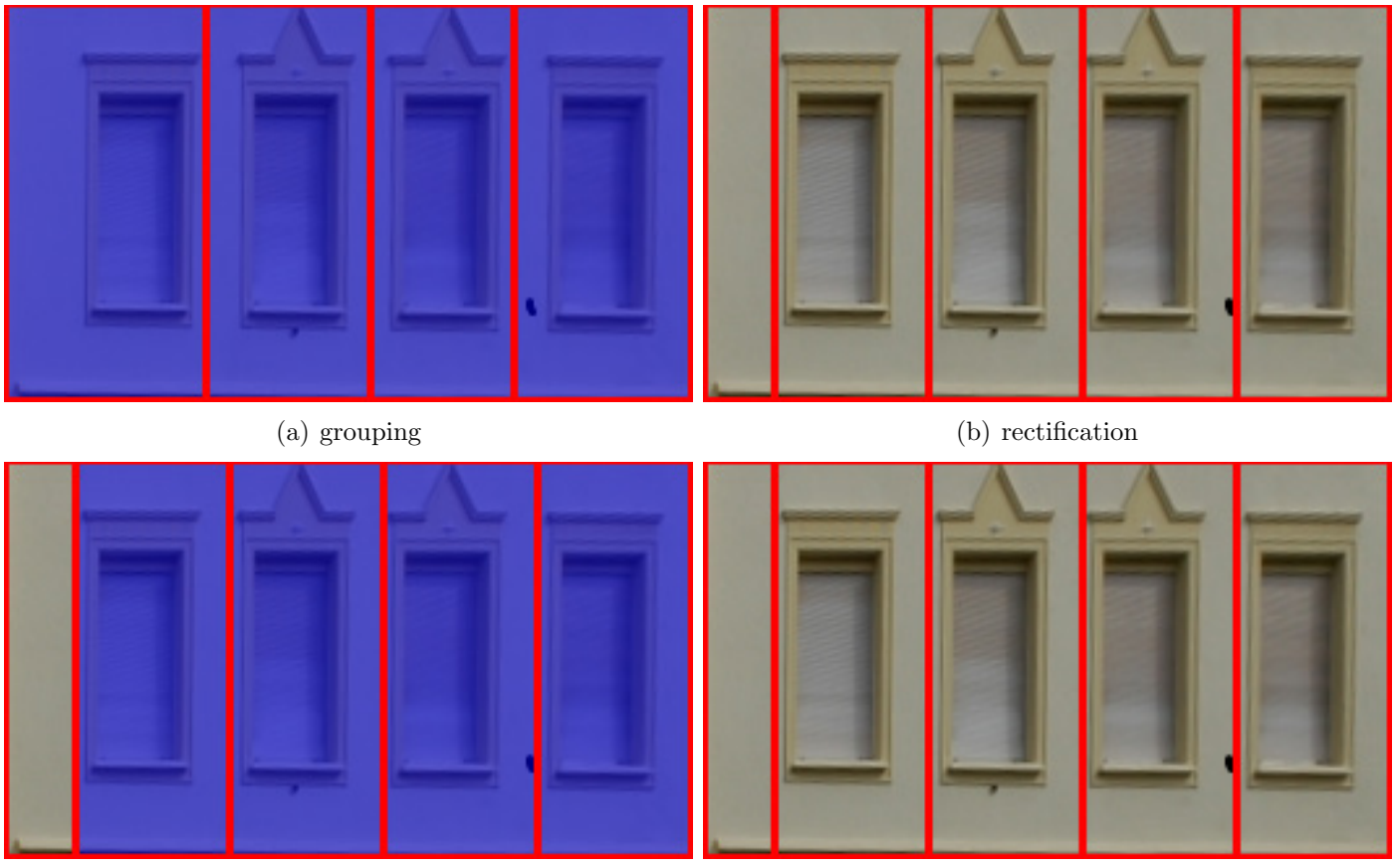
(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

(c) grouping (d) rectification

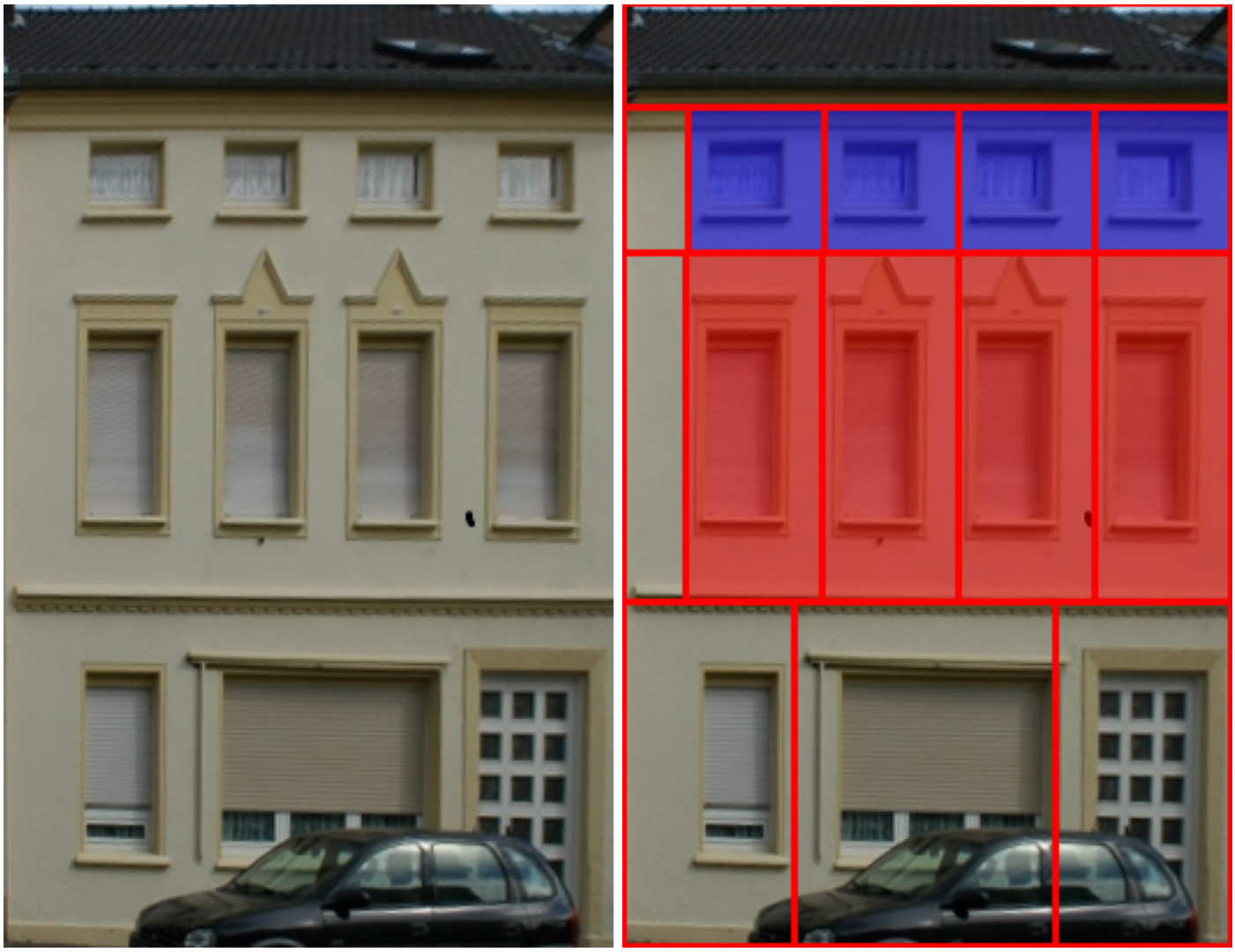
Figure 7: Level 2, group 2, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

Figure 9: Level 2, group 3, iteration of grouping and rectification.

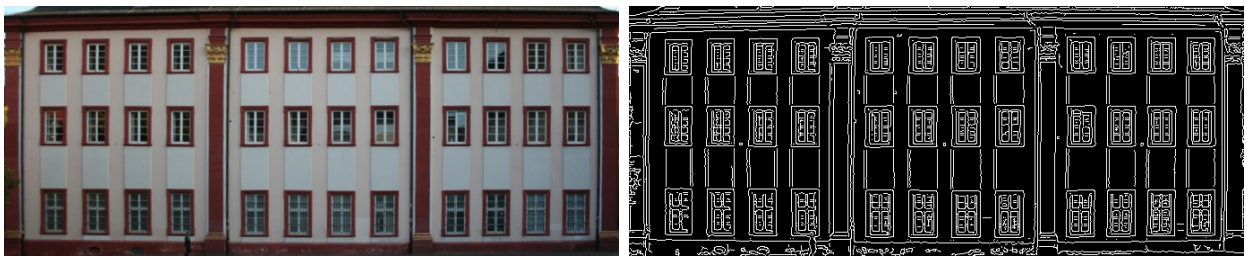


(a) input image

(b) output partition

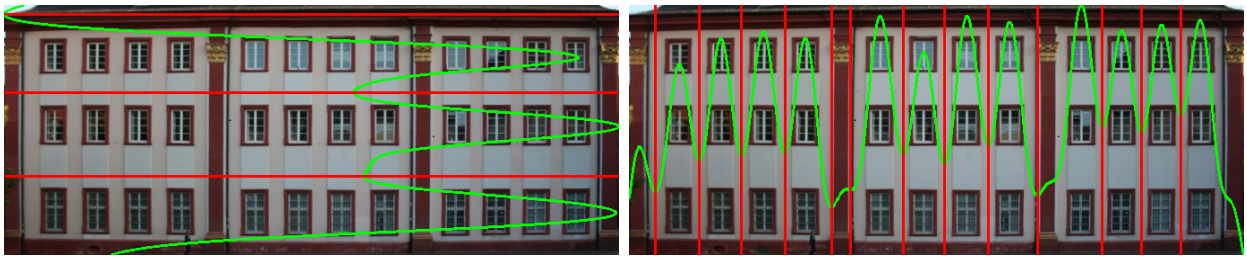
Figure 10: final result

Example #03



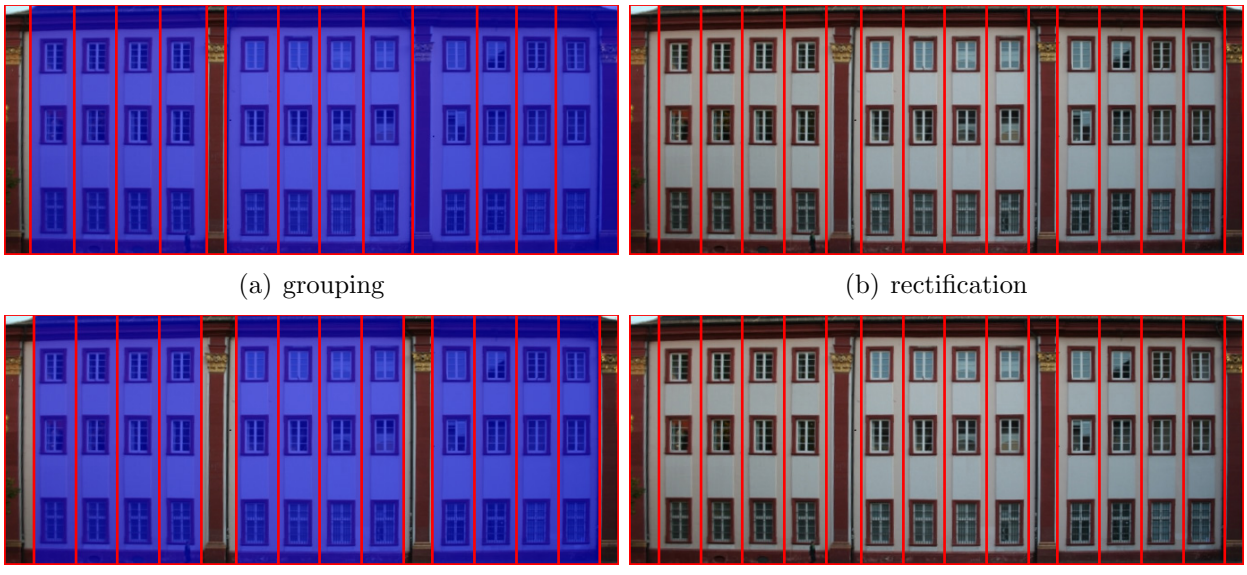
(a) (b)

Figure 1: Input image and detected edges



(a) horizontal (b) vertical

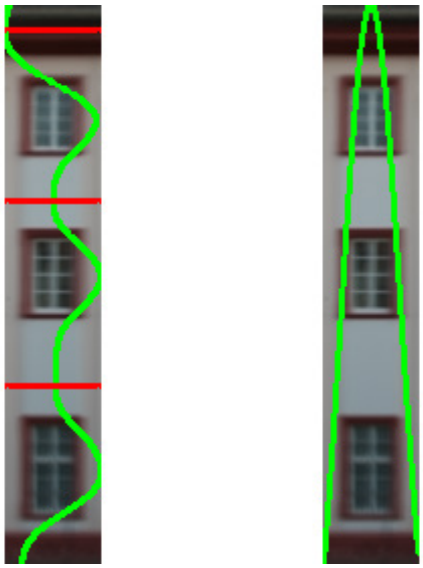
Figure 2: Level 1, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

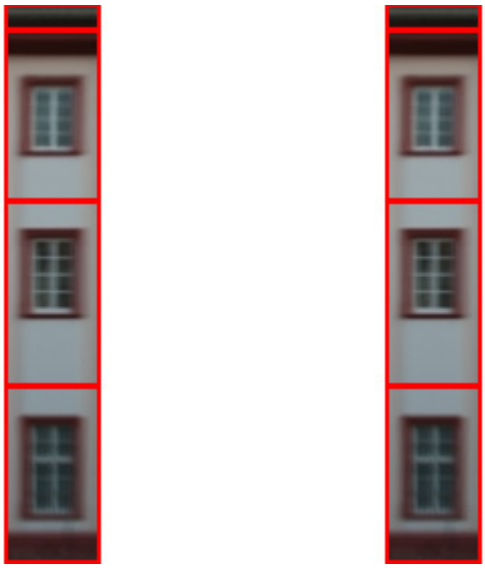
(c) grouping (d) rectification

Figure 3: Level 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: horizontal.



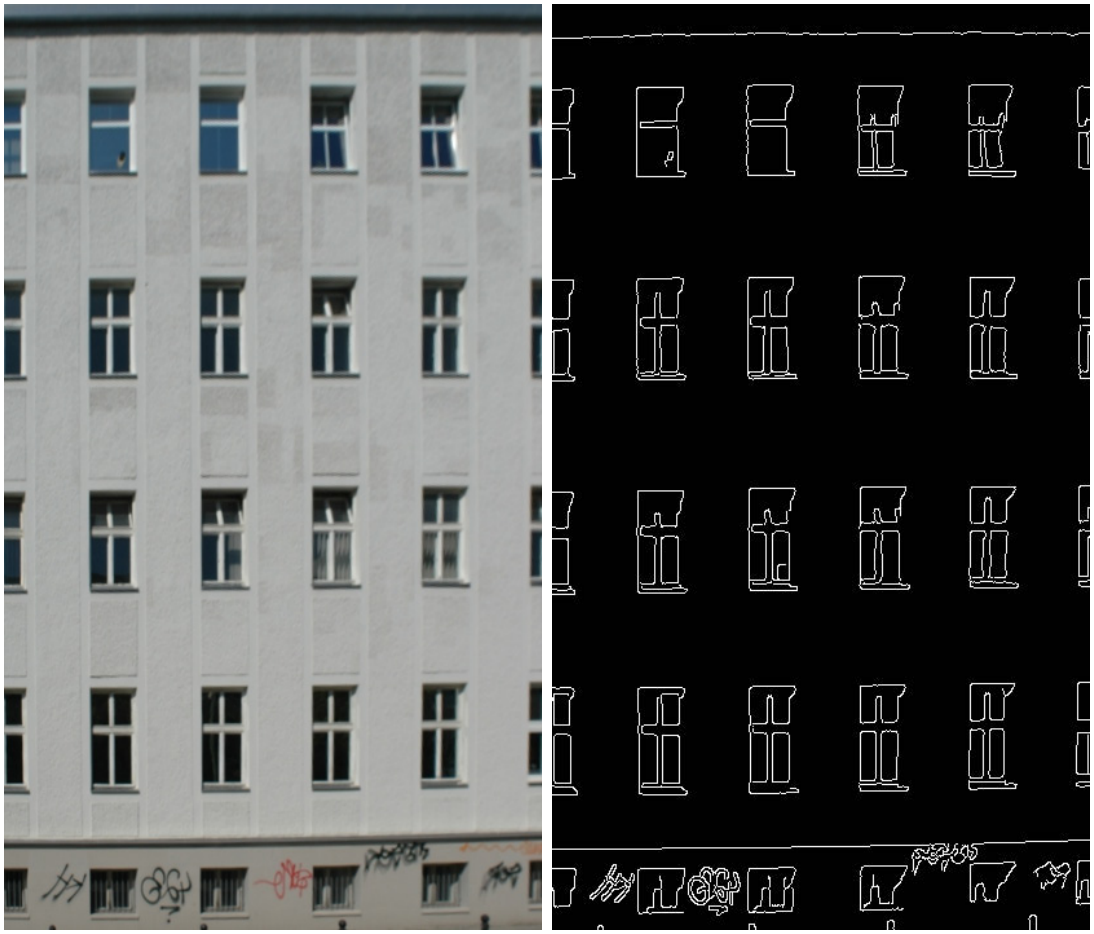
(a) grouping (b) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

(a) input image (b) output partition

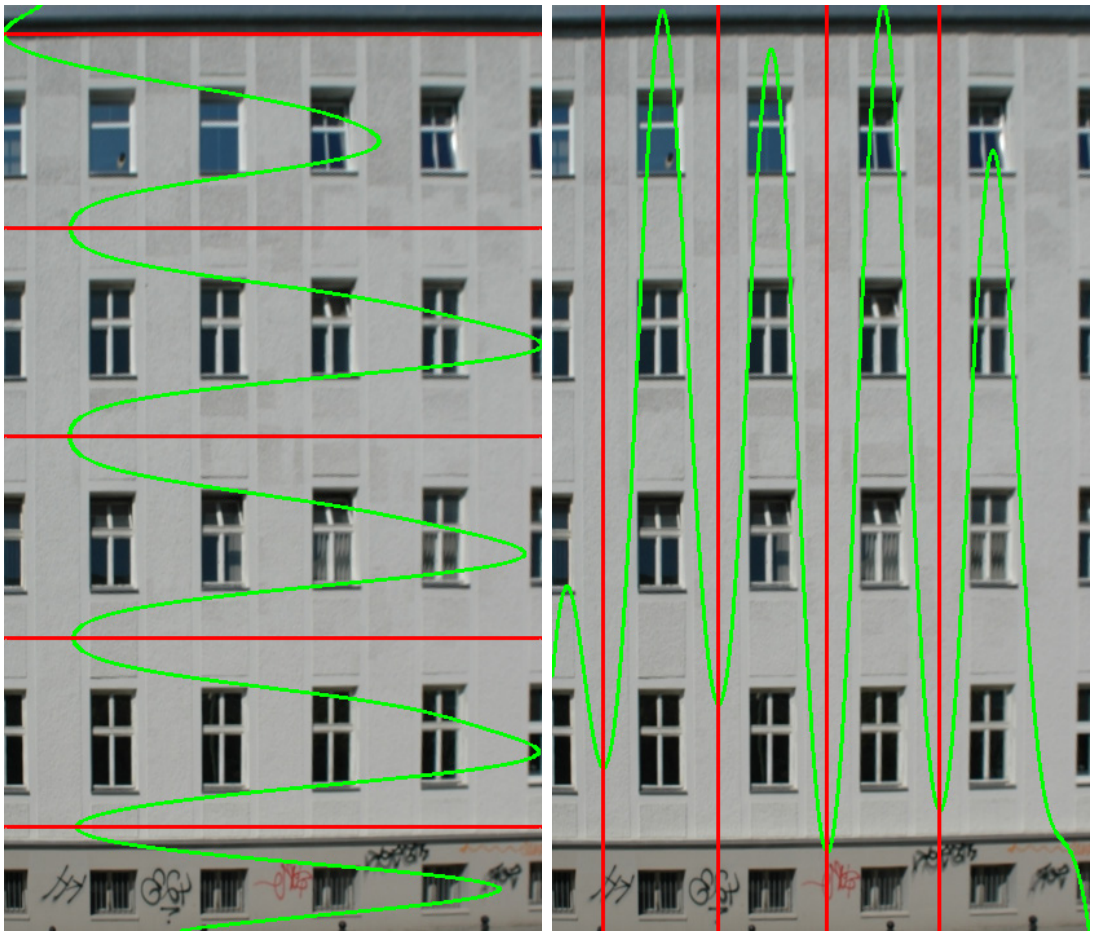
Figure 6: final result

Example #04



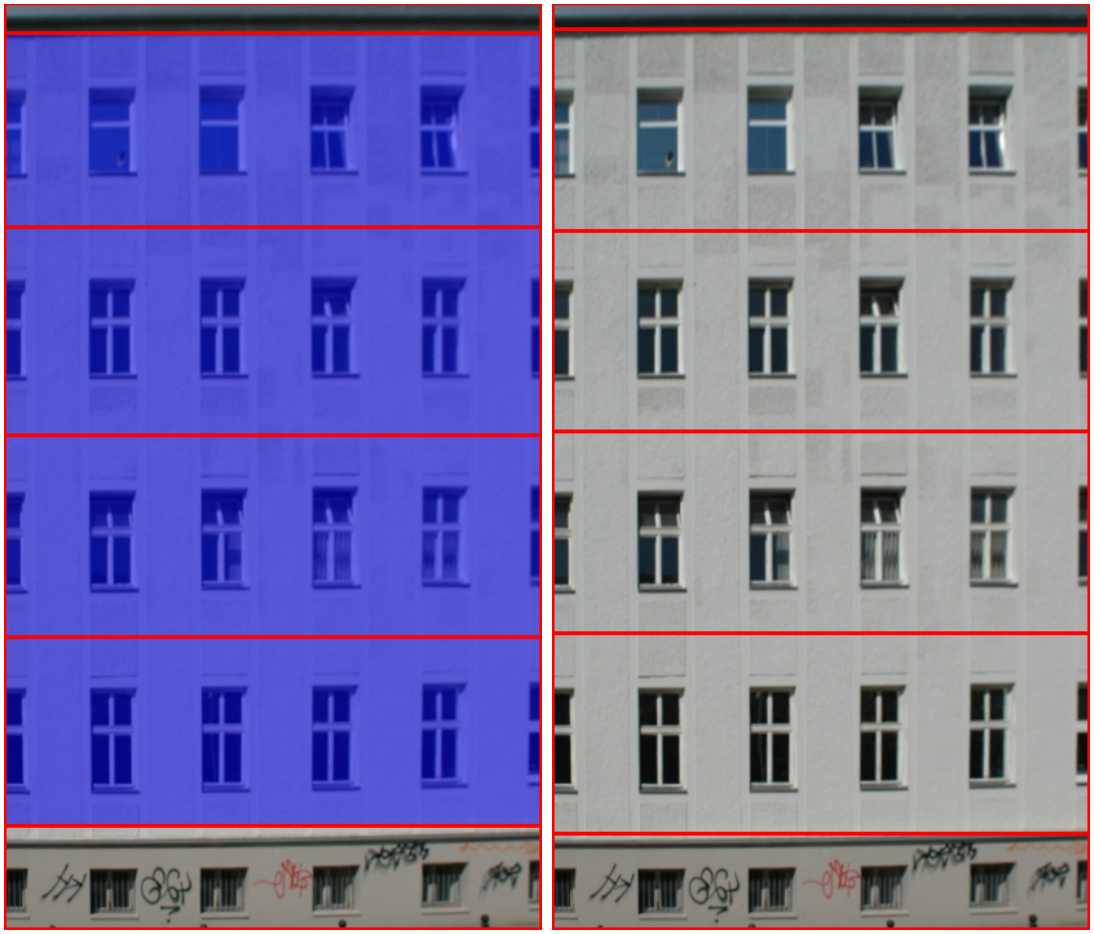
(a) (b)

Figure 1: Input image and detected edges

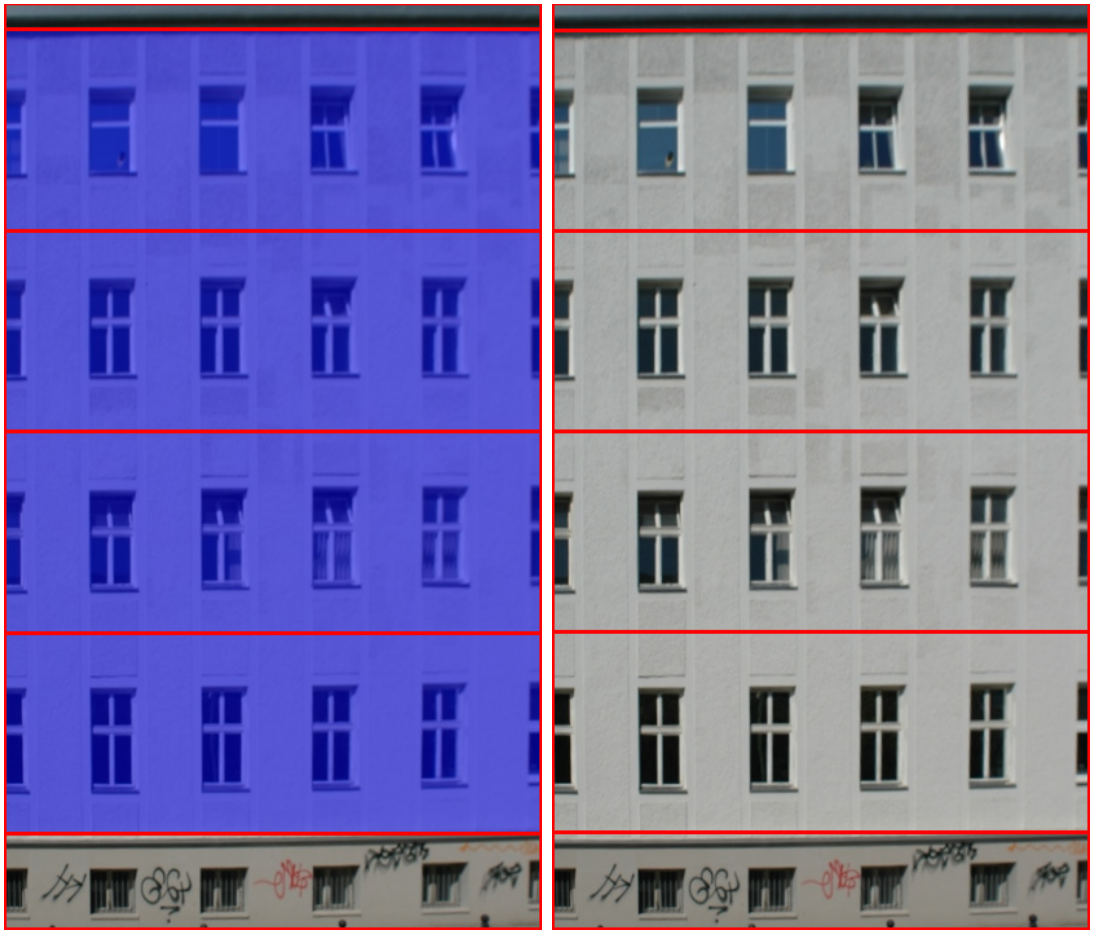


(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

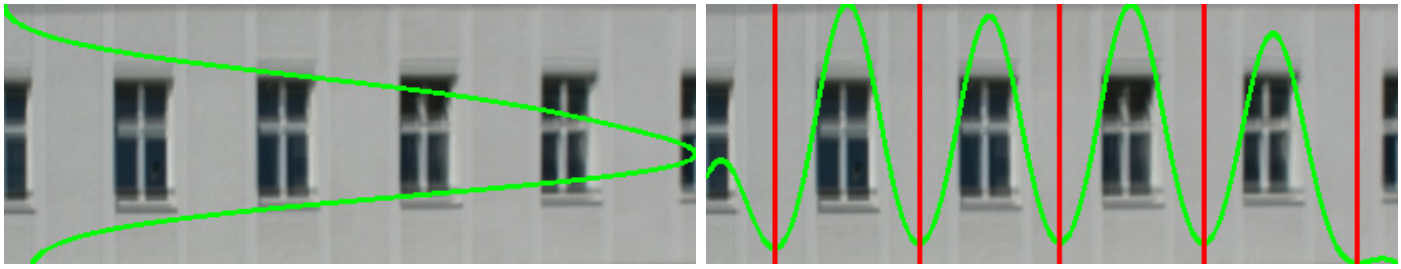


(a) grouping (b) rectification



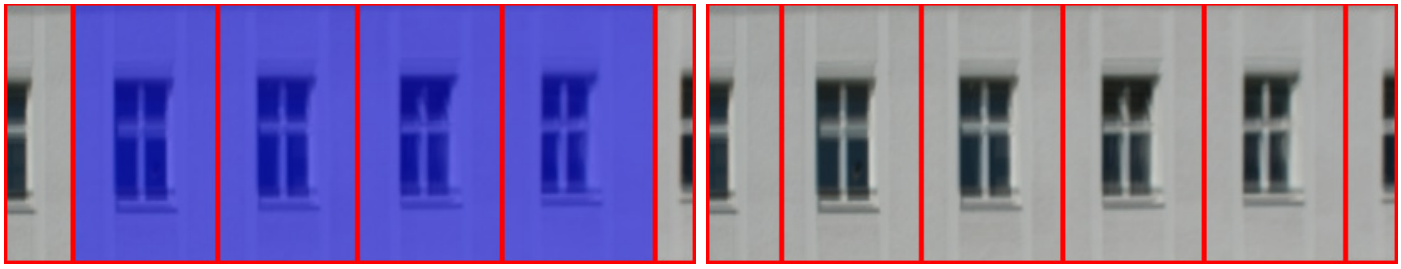
(c) grouping (d) rectification

Figure 3: Level 1, iteration of grouping and rectification.

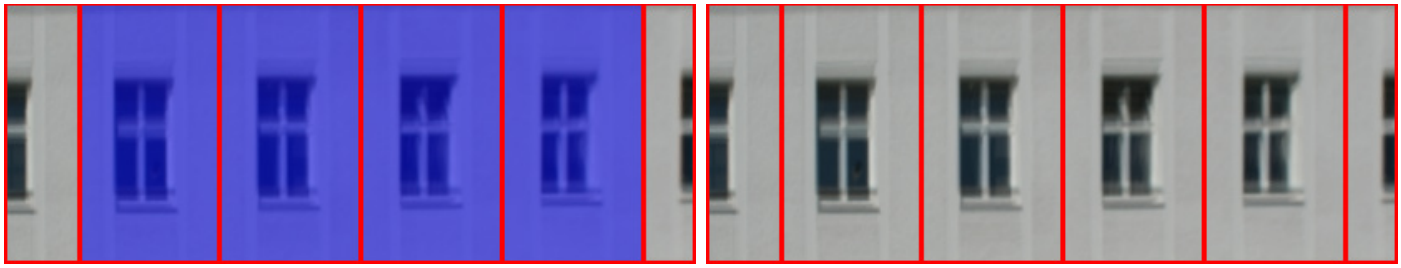


(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification



(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

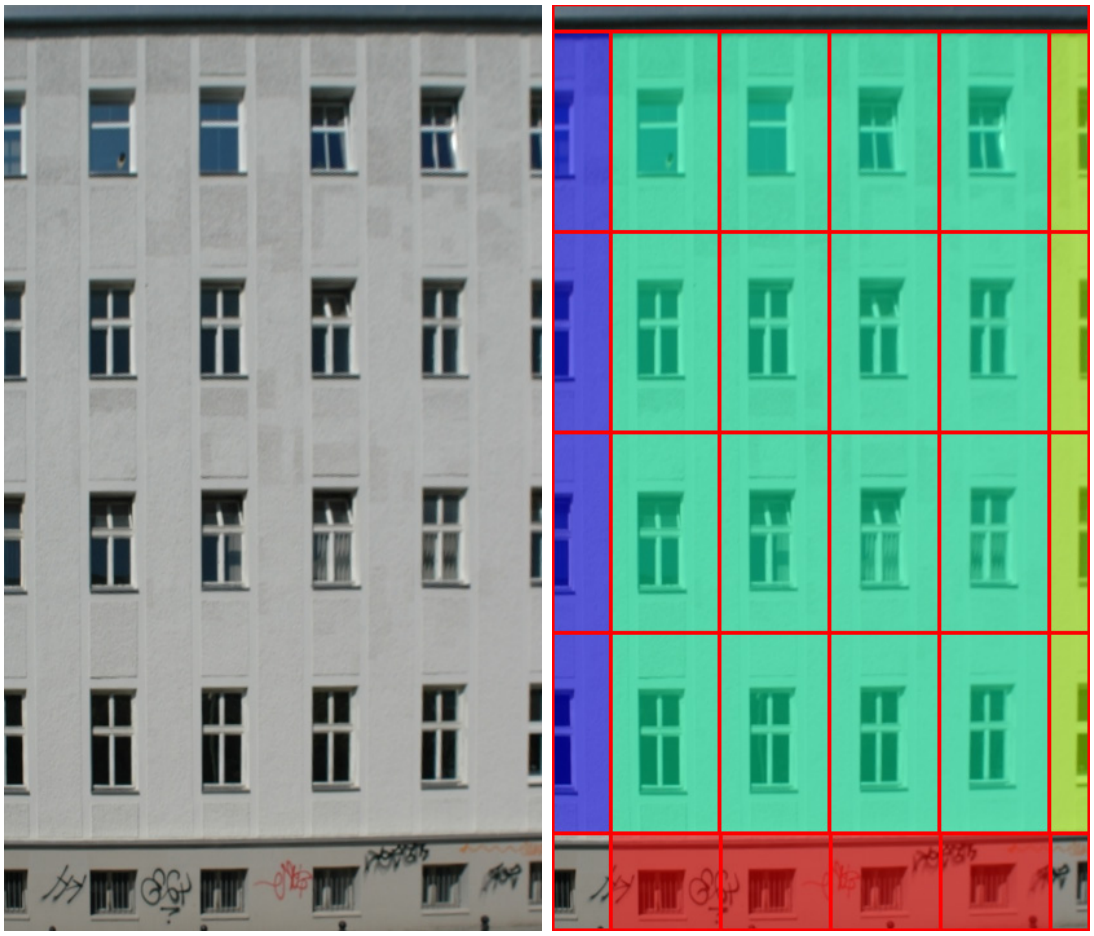
Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

(c) grouping (d) rectification

(e) grouping (f) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.



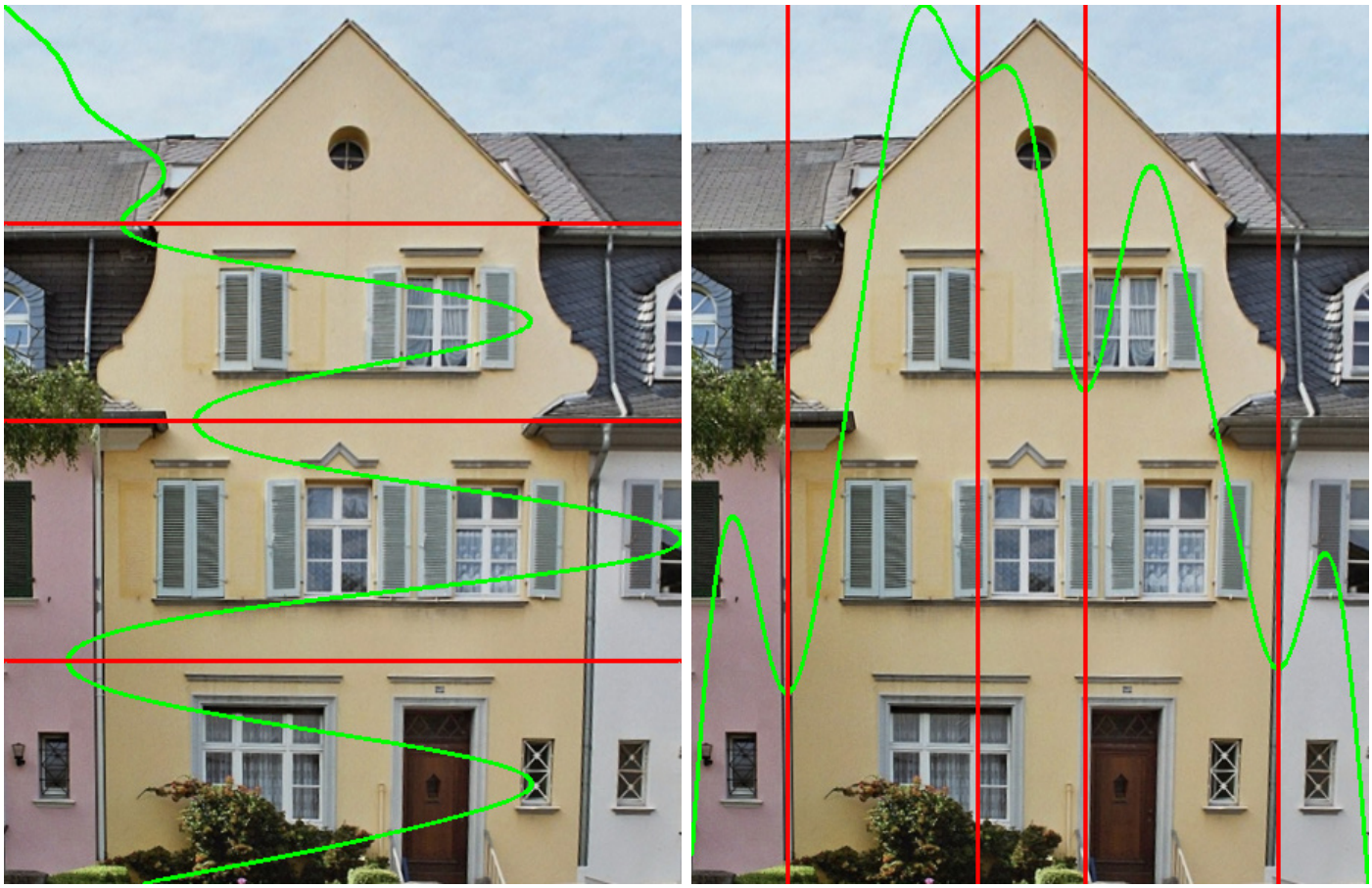
(a) input image (b) output partition

Figure 8: final result

Example #05

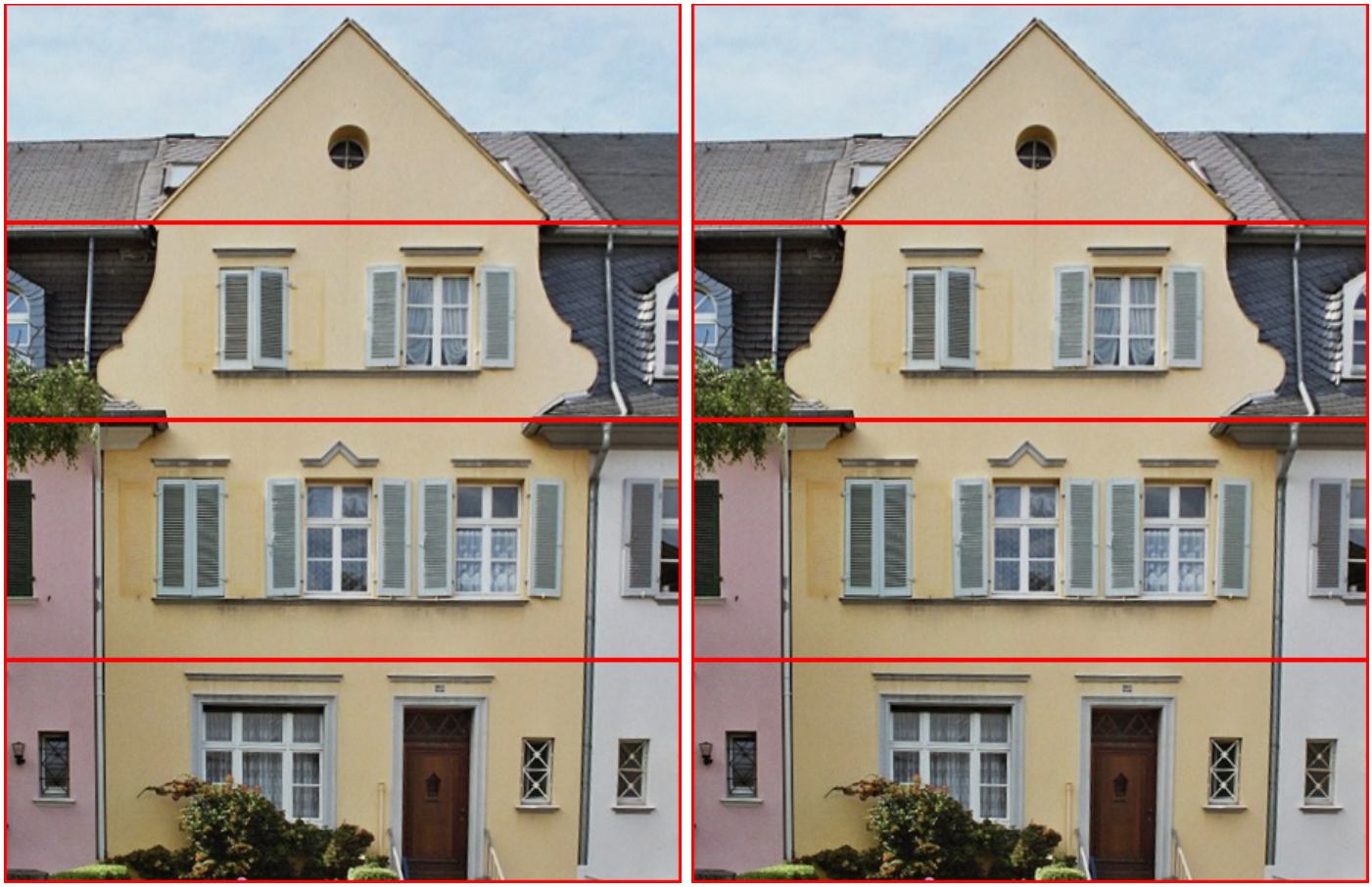
(a) (b)

Figure 1: Input image and detected edges



(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.



(a) grouping (b) rectification

Figure 3: Level 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

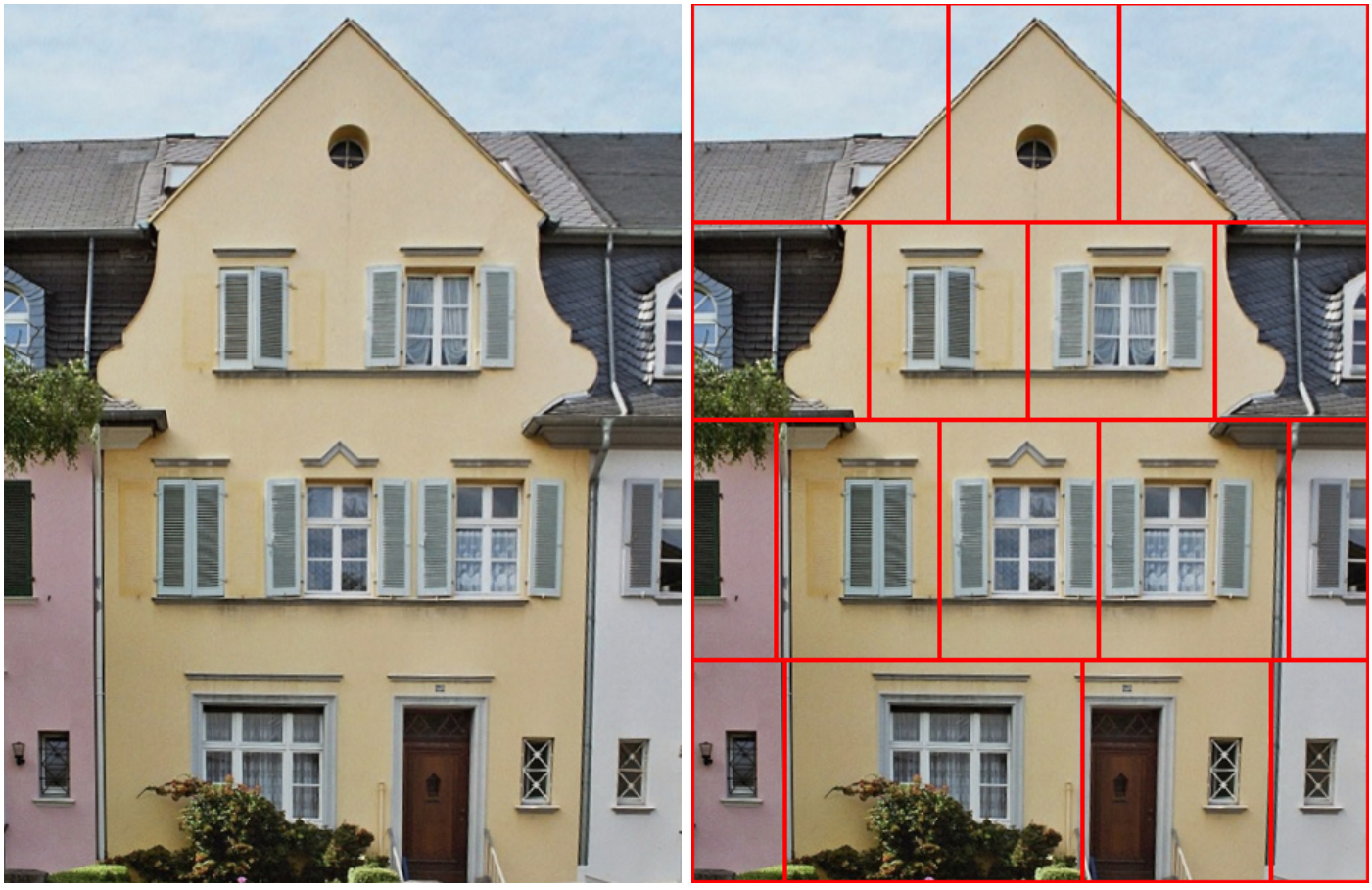
Figure 9: Level 2, group 3, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 10: Level 2, group 3, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

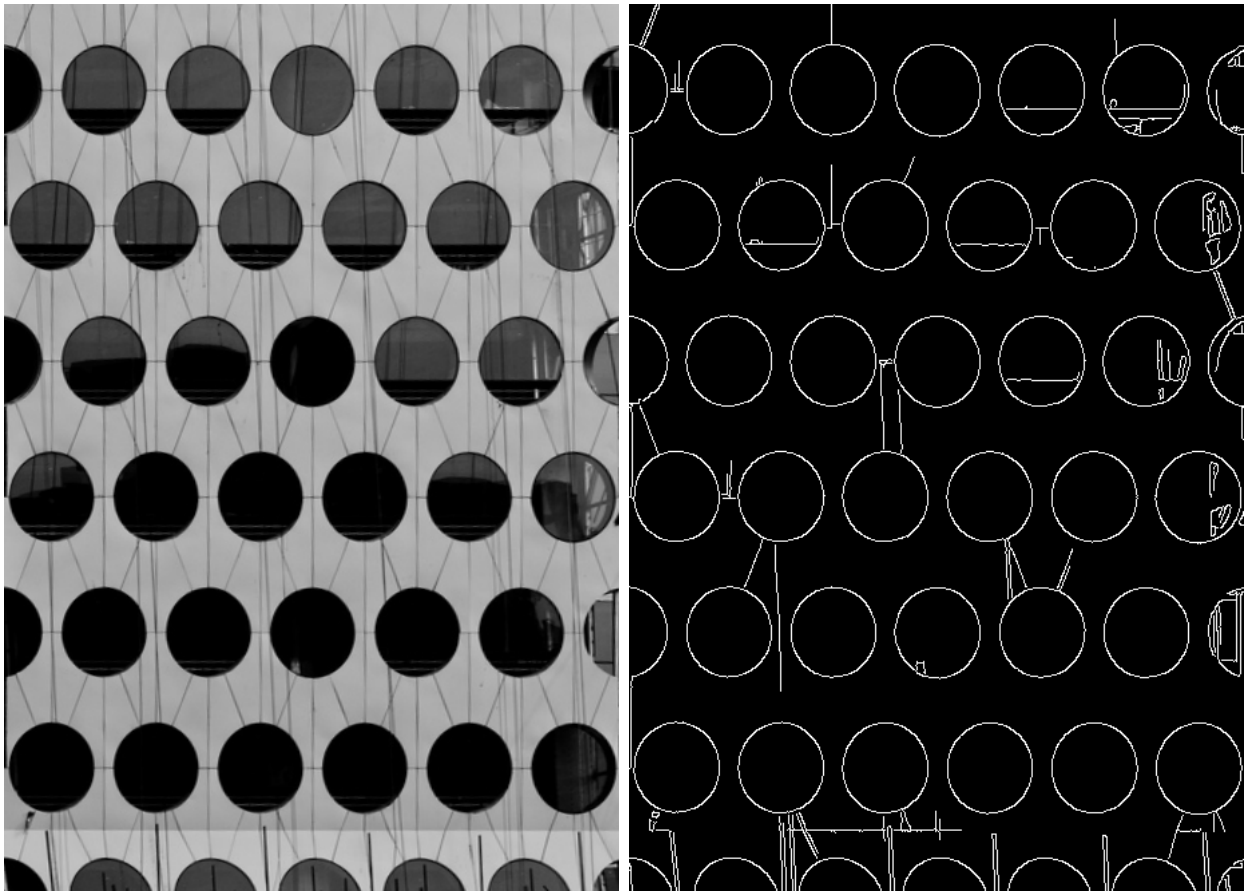
Figure 11: Level 2, group 3, iteration of grouping and rectification.



(a) input image (b) output partition

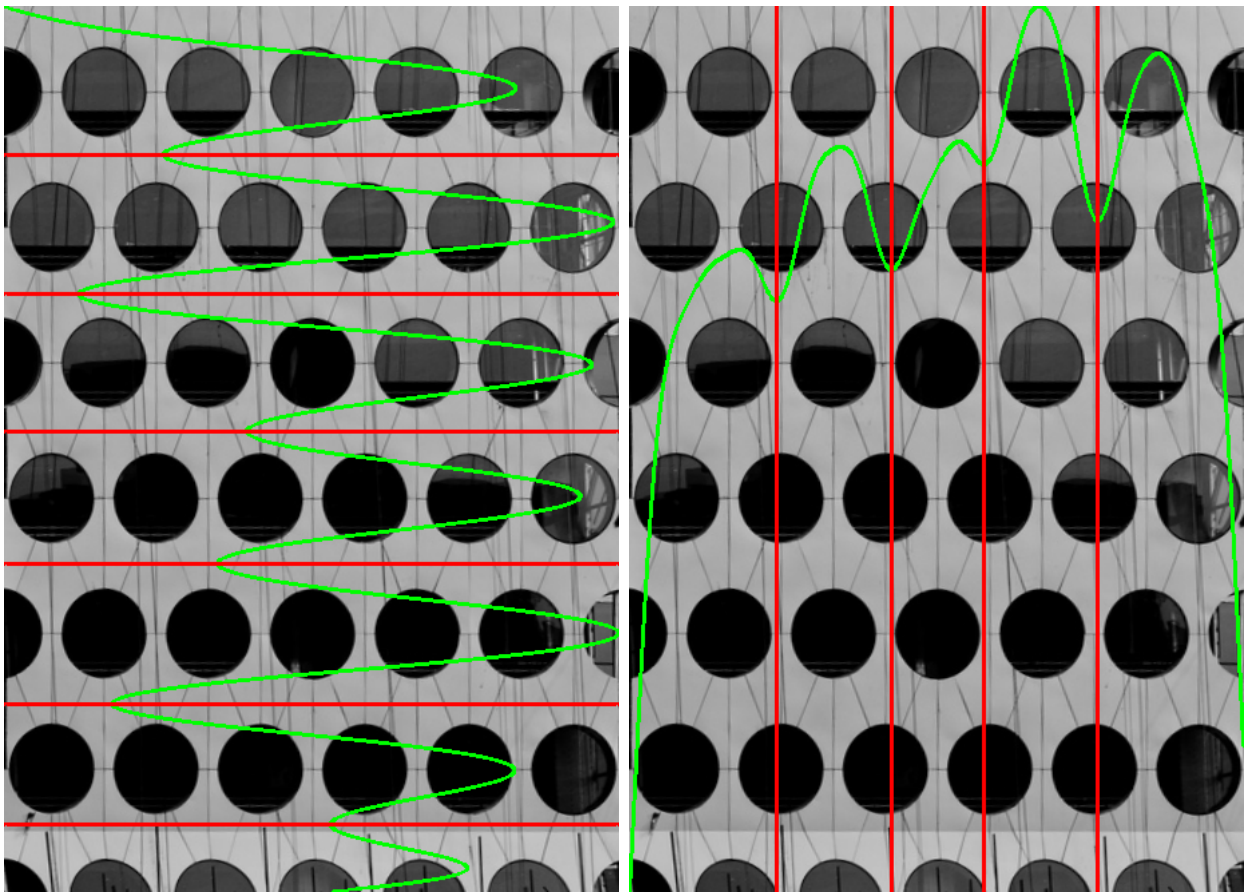
Figure 12: final result

Example #06



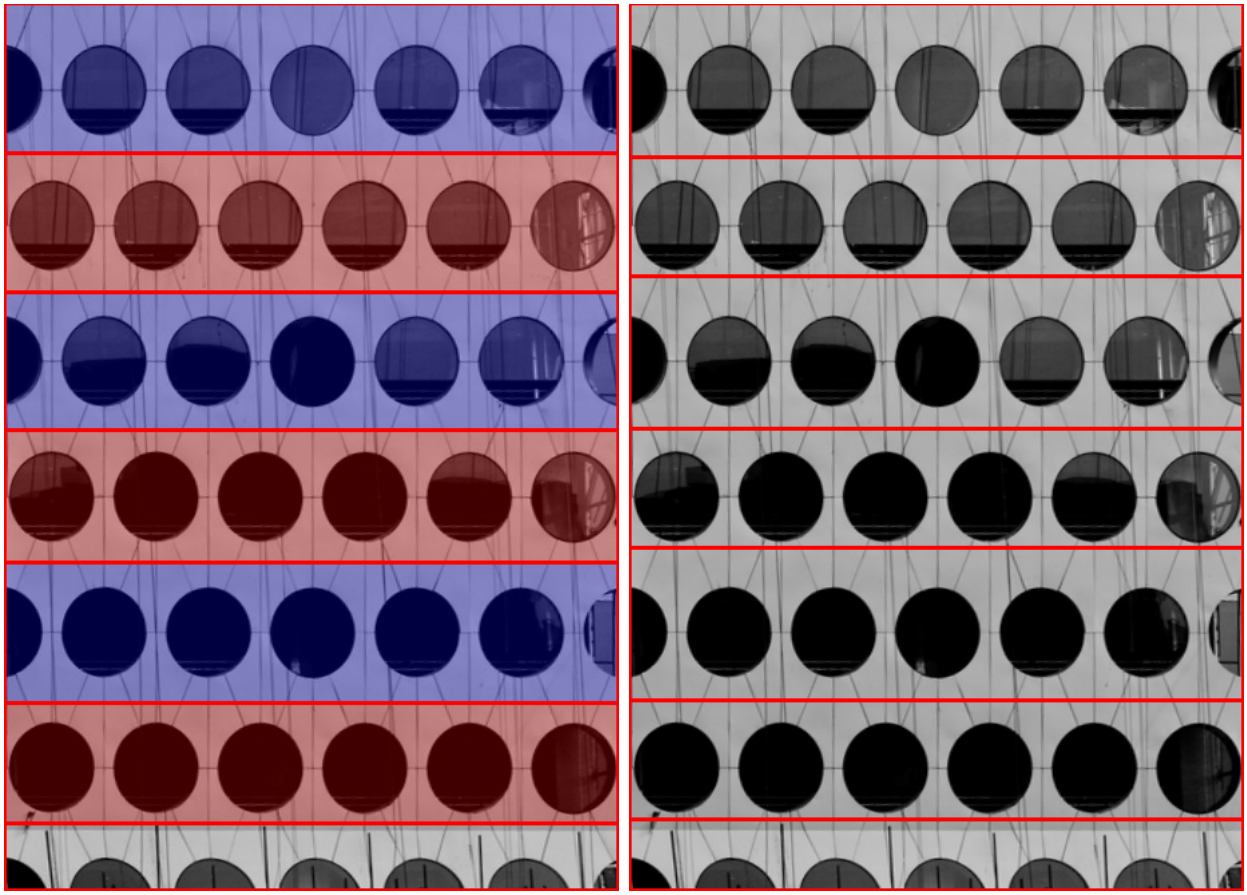
(a) (b)

Figure 1: Input image and detected edges

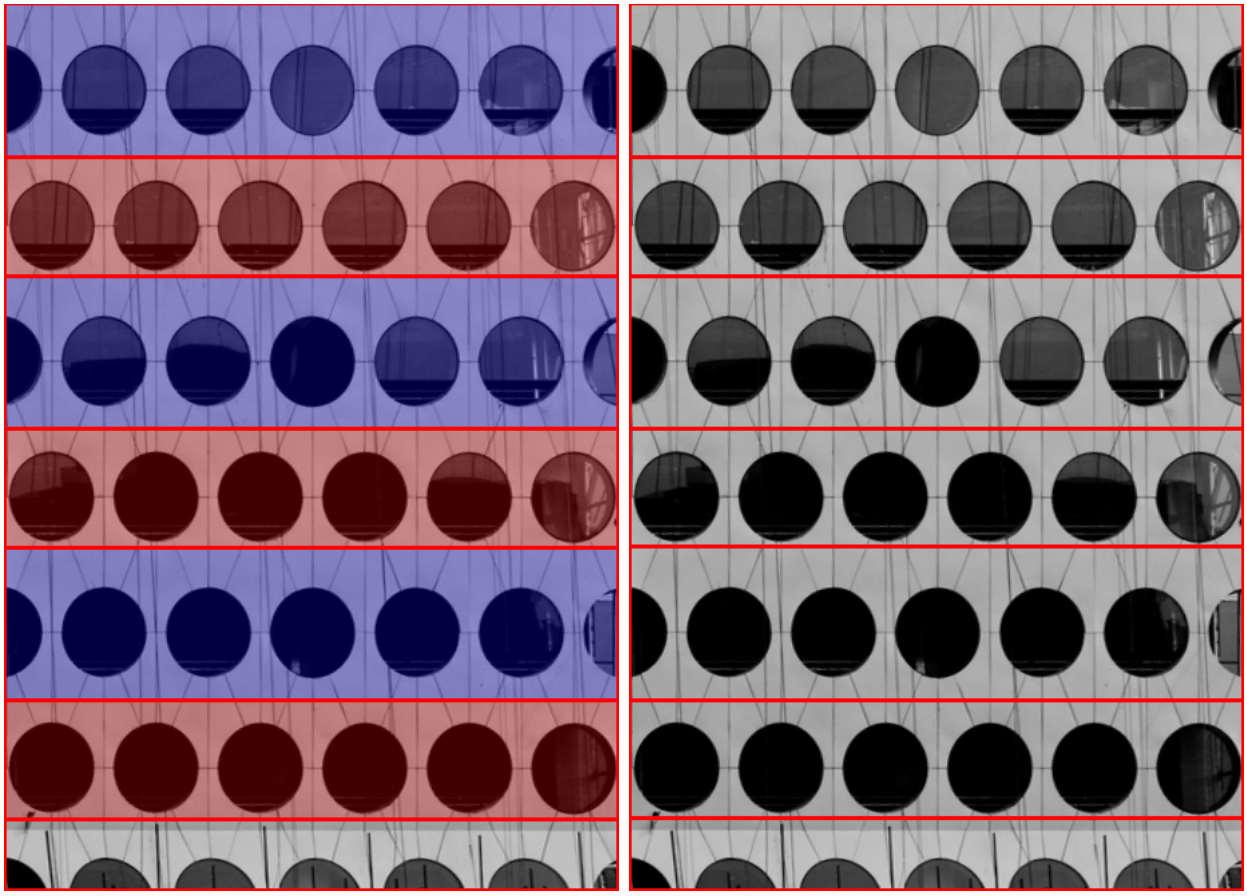


(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

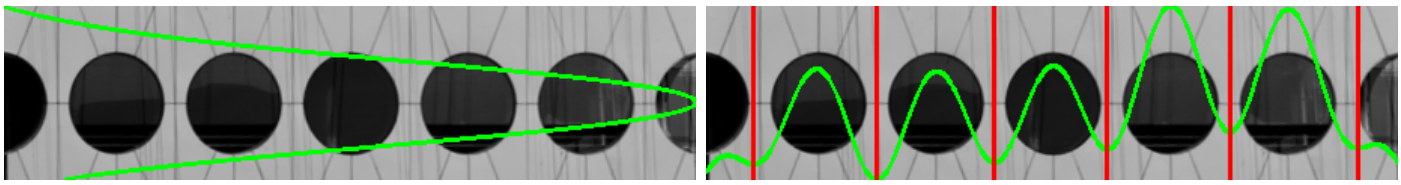


(a) grouping (b) rectification



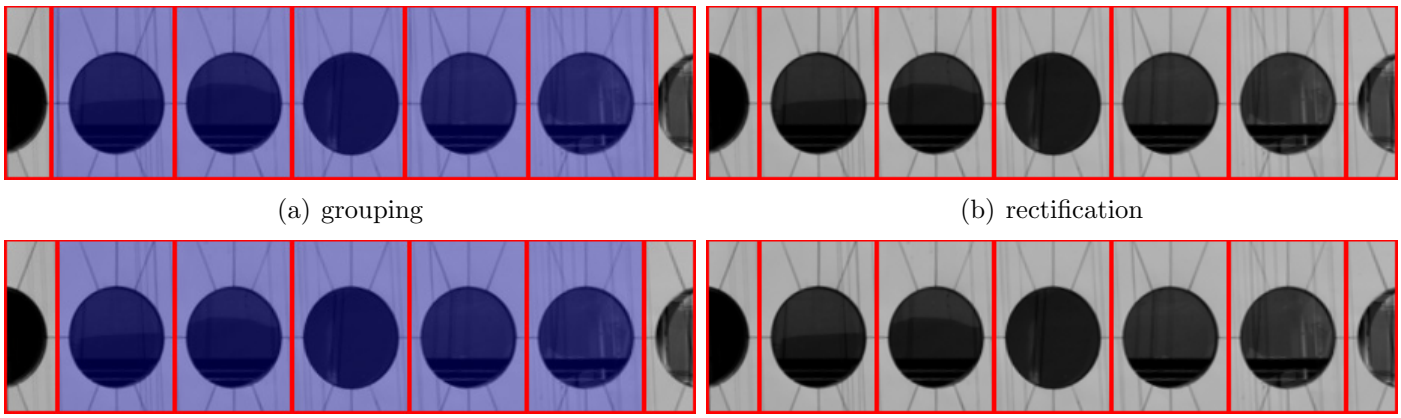
(c) grouping (d) rectification

Figure 3: Level 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

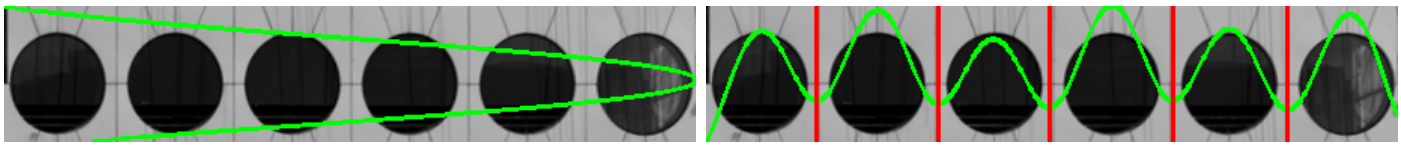
Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

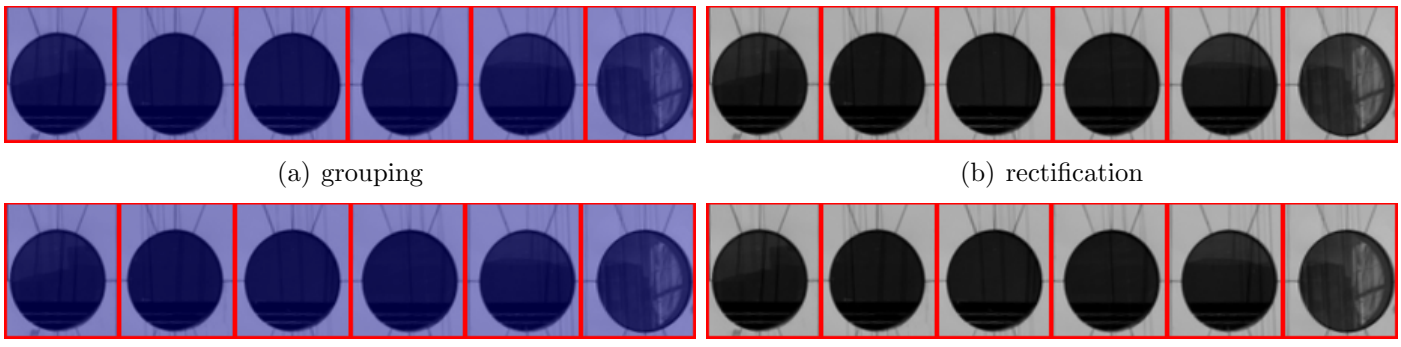
(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

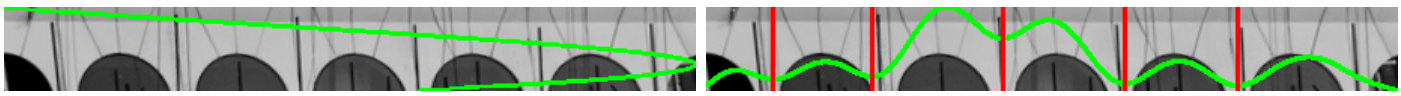
Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

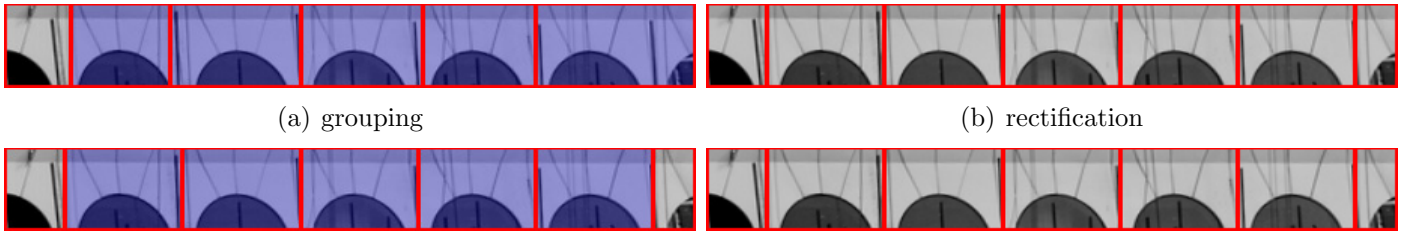
(c) grouping (d) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.



(a) horizontal (b) vertical

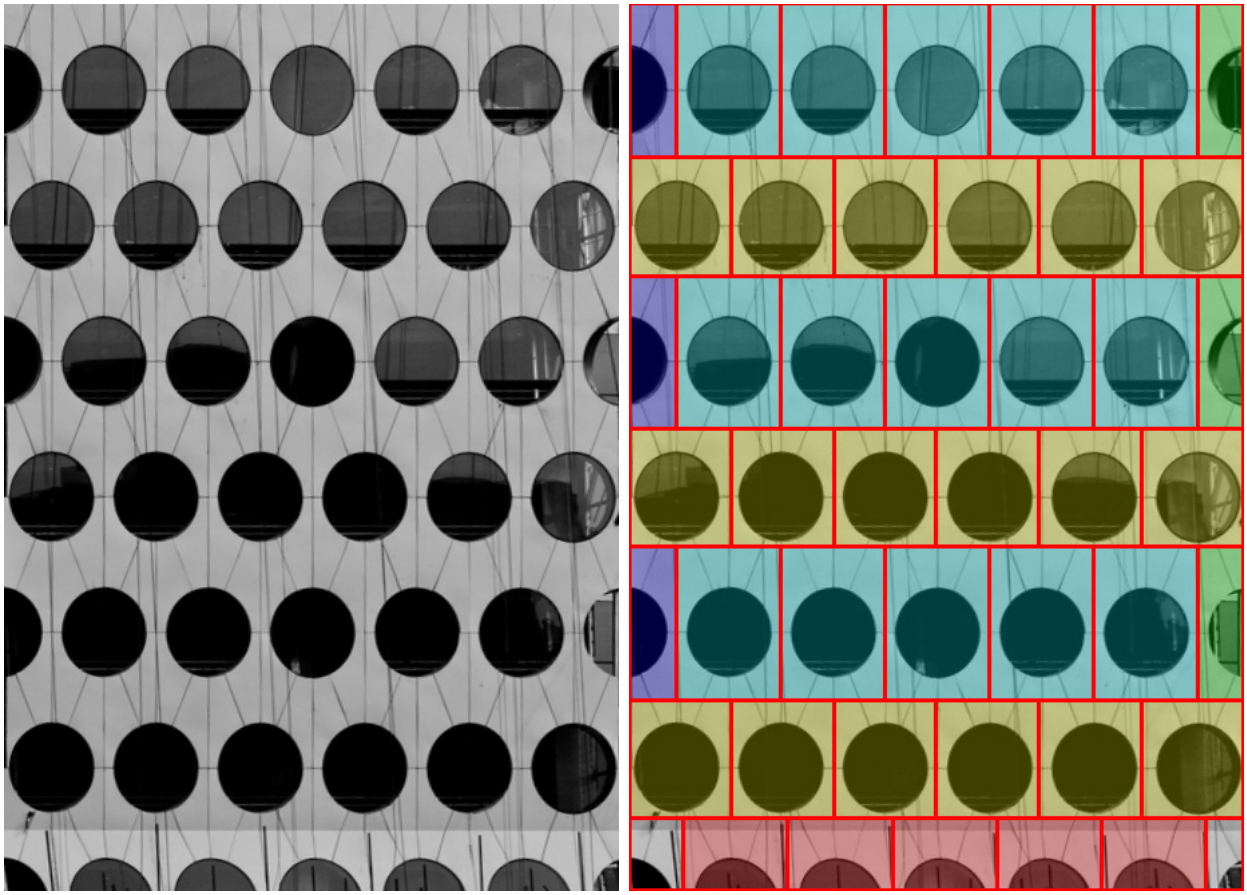
Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

(c) grouping (d) rectification

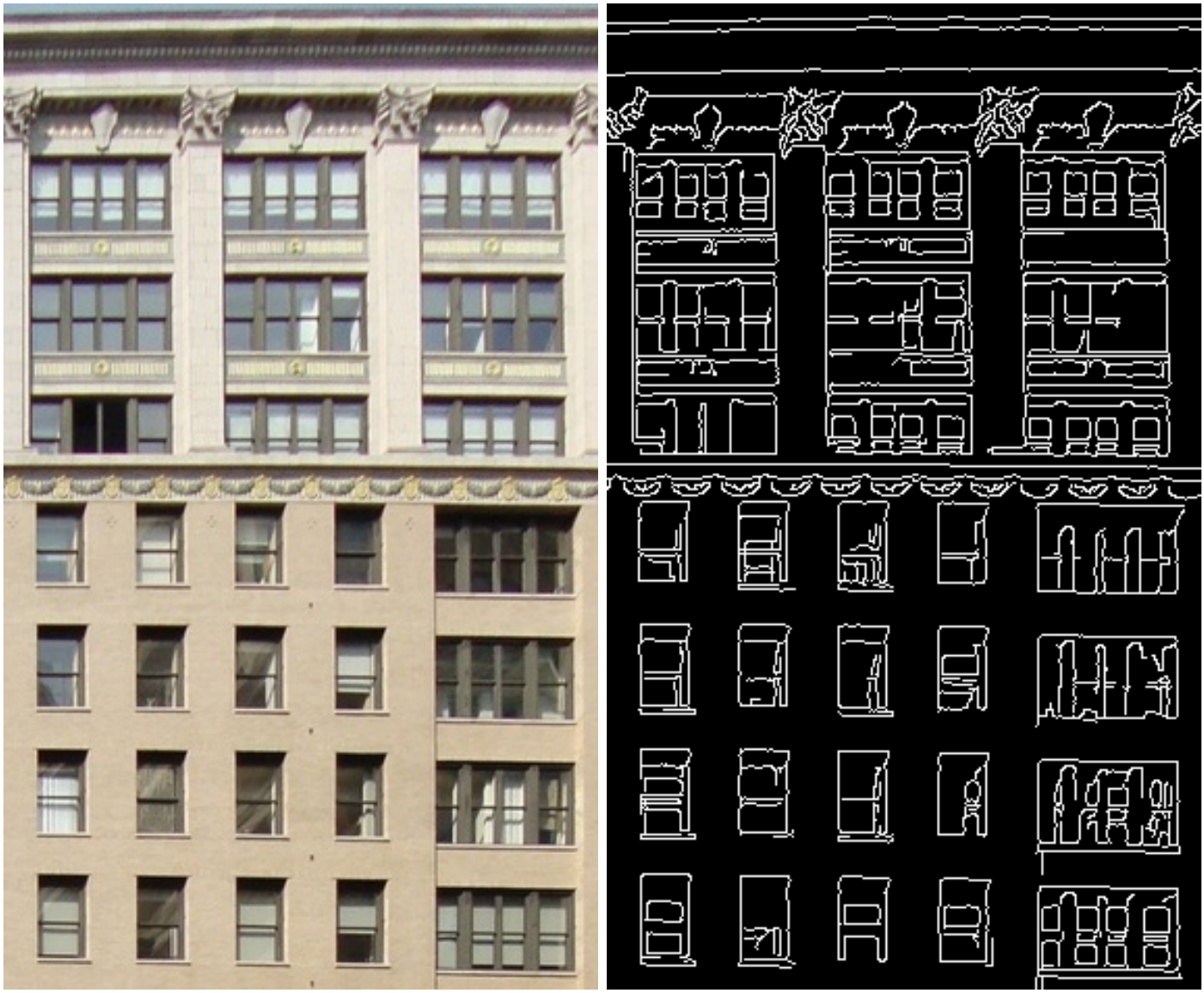
Figure 9: Level 2, group 3, iteration of grouping and rectification.



(a) input image (b) output partition

Figure 10: final result

Example #07



(a) (b)

Figure 1: Input image and detected edges

(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

(c) grouping (d) rectification

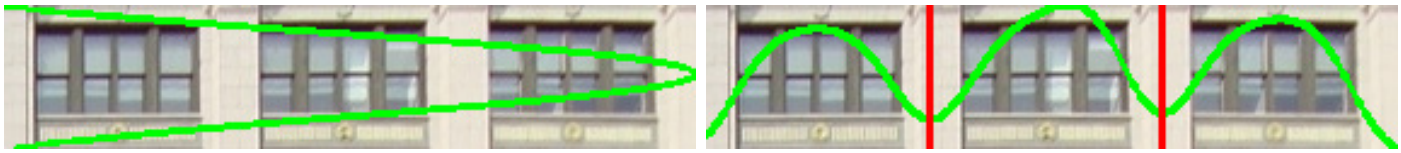
Figure 3: Level 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.

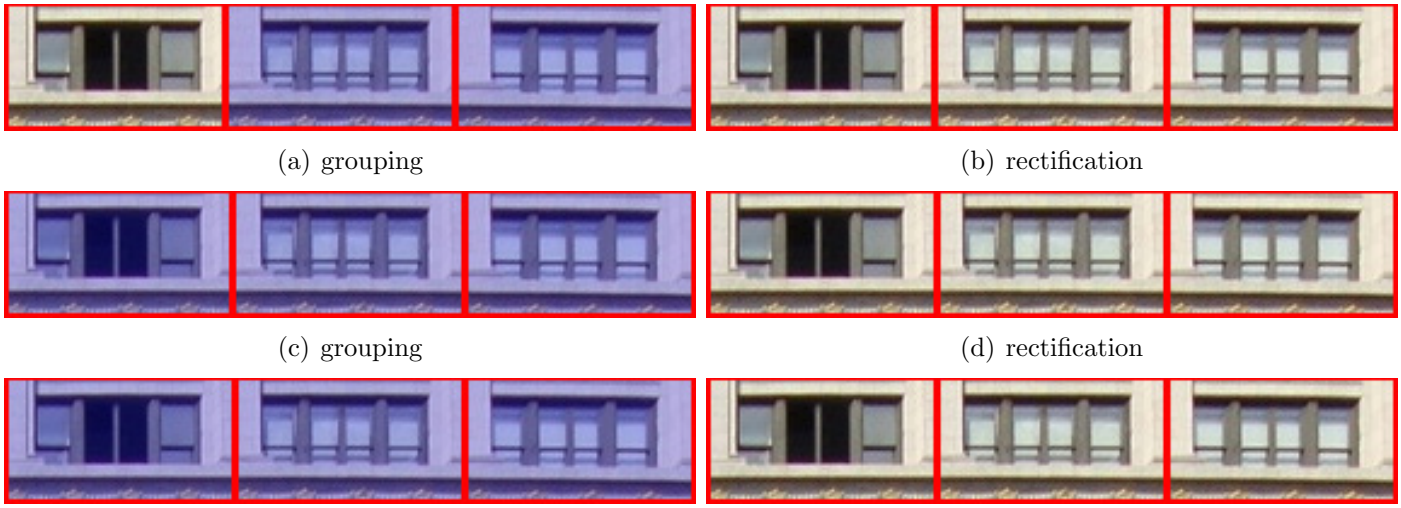
(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

(c) grouping (d) rectification

(e) grouping (f) rectification

Figure 9: Level 2, group 3, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 10: Level 2, group 4, penalty function. Determined splitting direction: vertical.

(a) grouping (b) rectification

(c) grouping (d) rectification

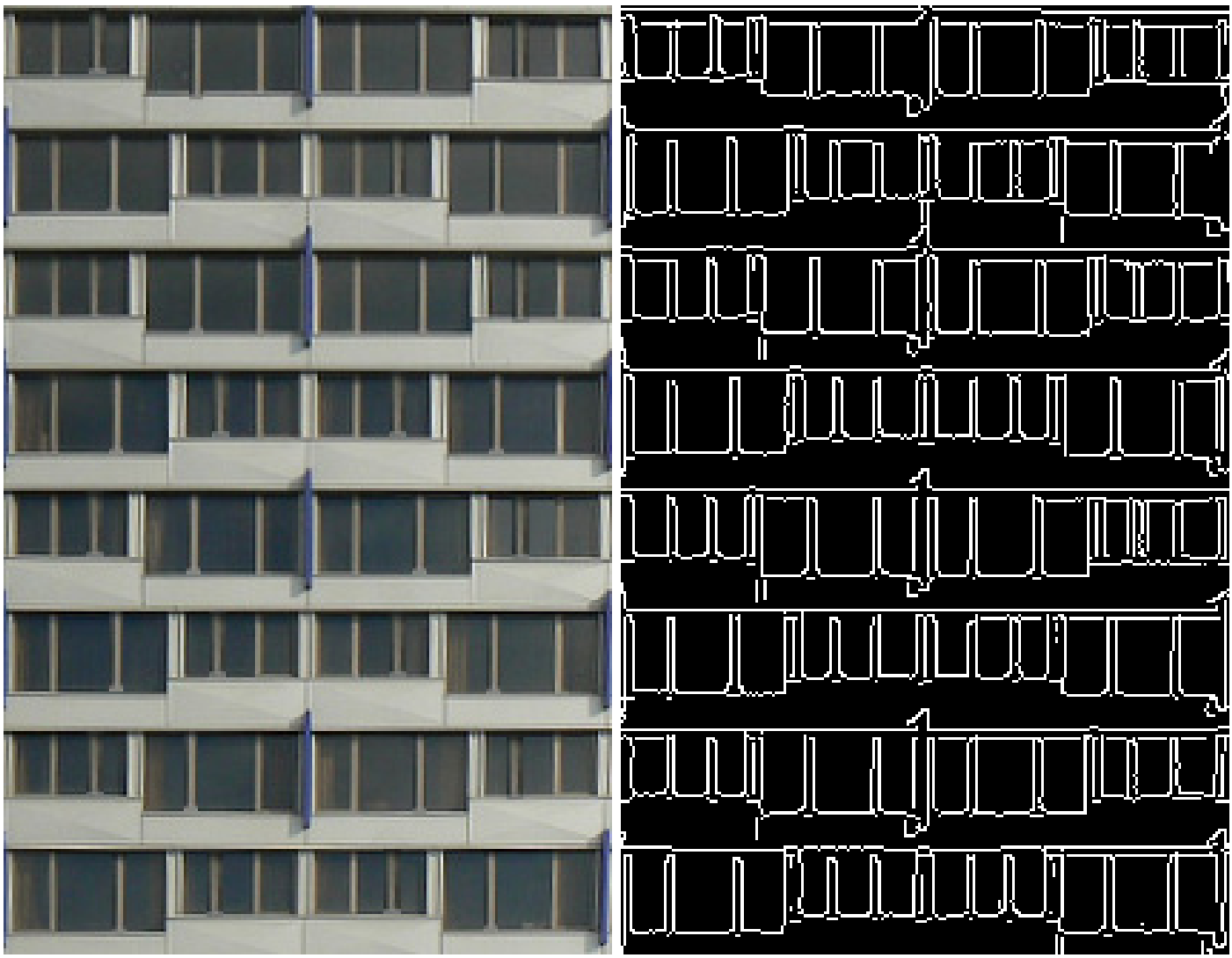
Figure 11: Level 2, group 4, iteration of grouping and rectification.

(a) input image

(b) output partition

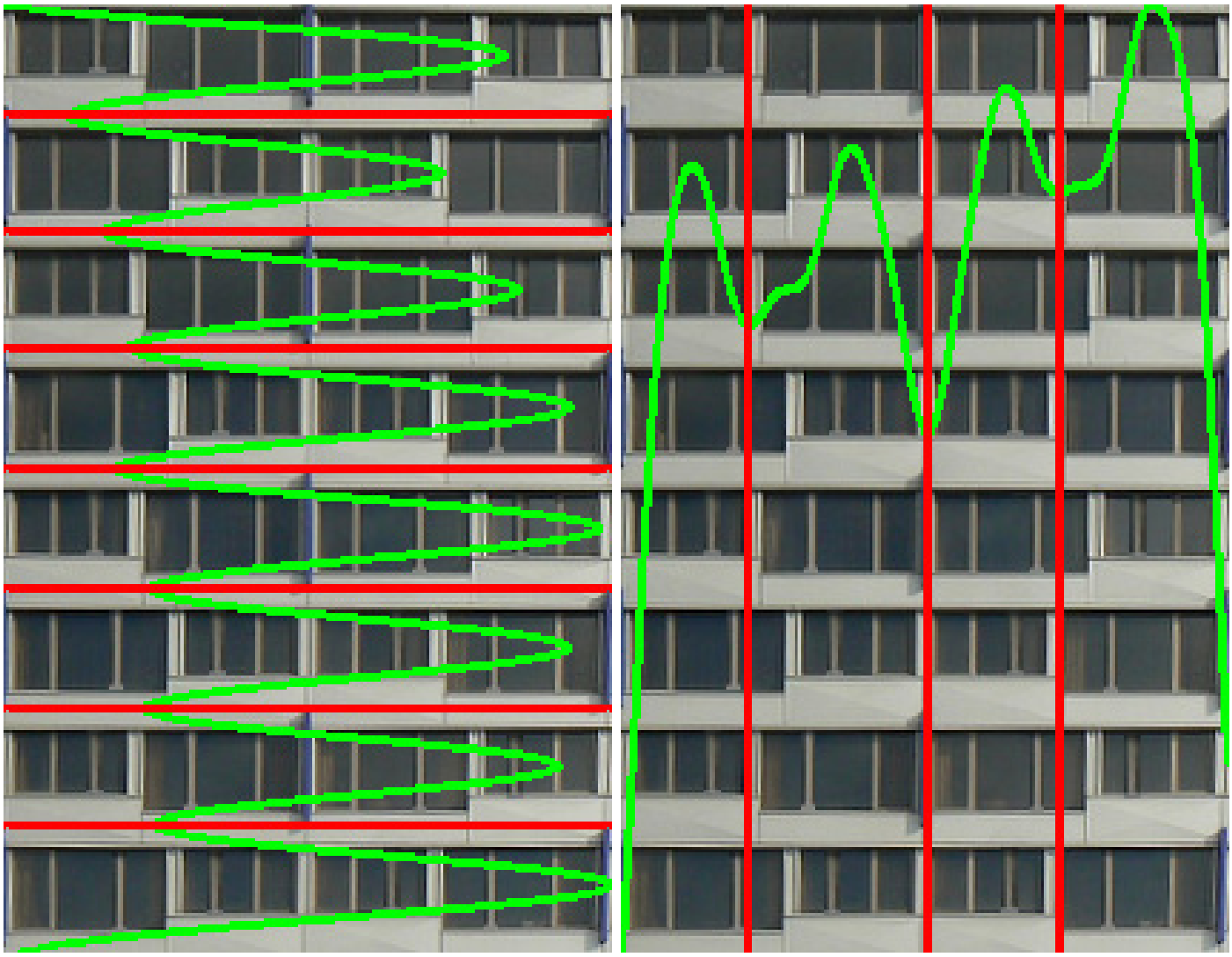
Figure 12: final result

Example #08



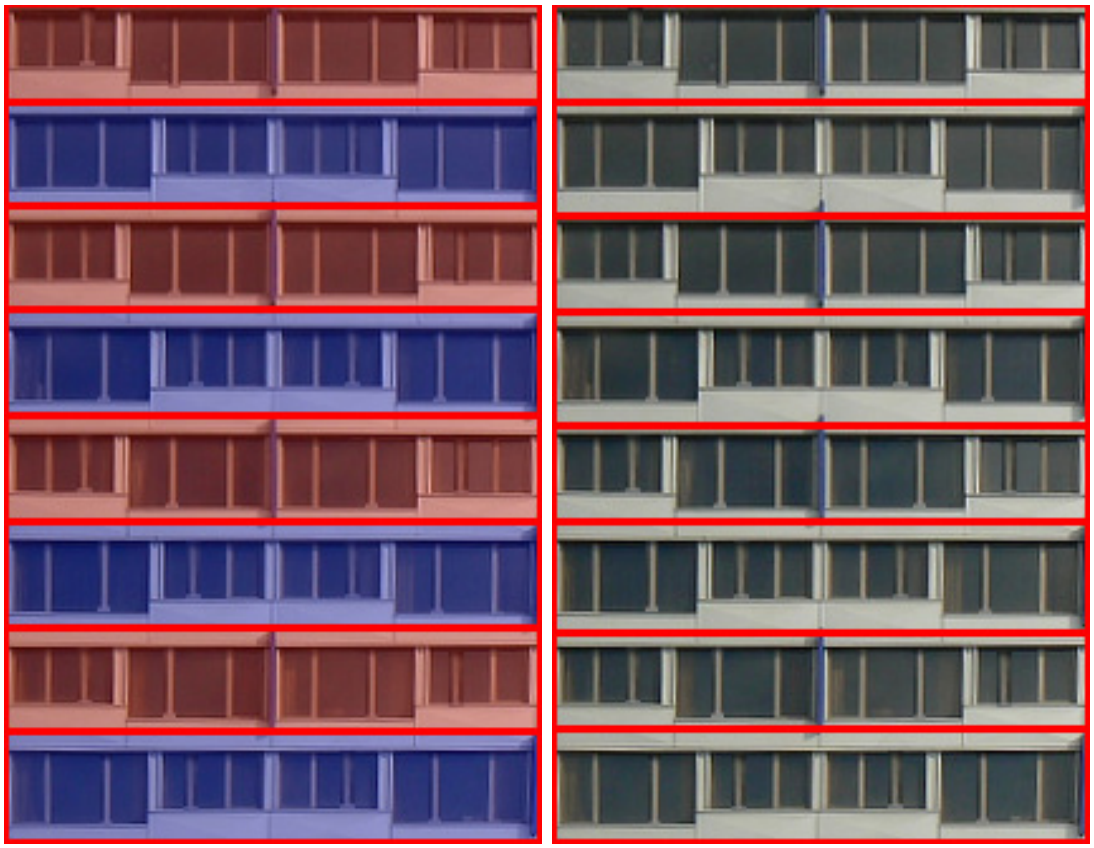
(a) (b)

Figure 1: Input image and detected edges

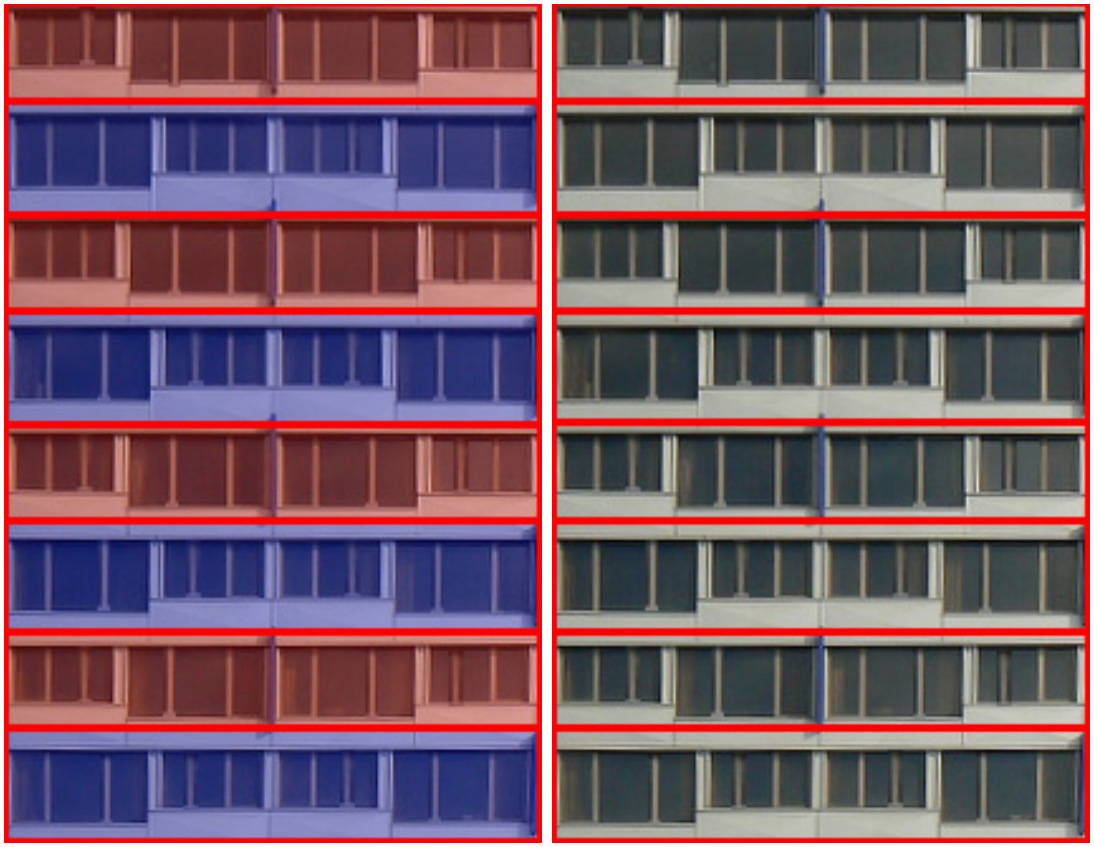


(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

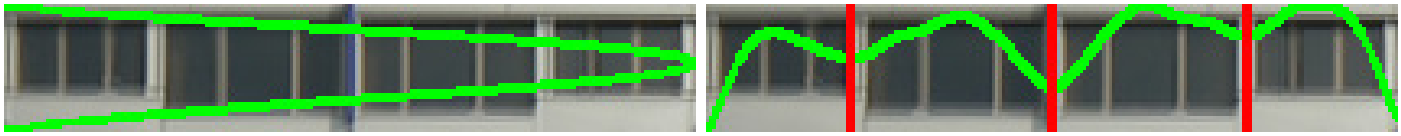


(a) grouping (b) rectification



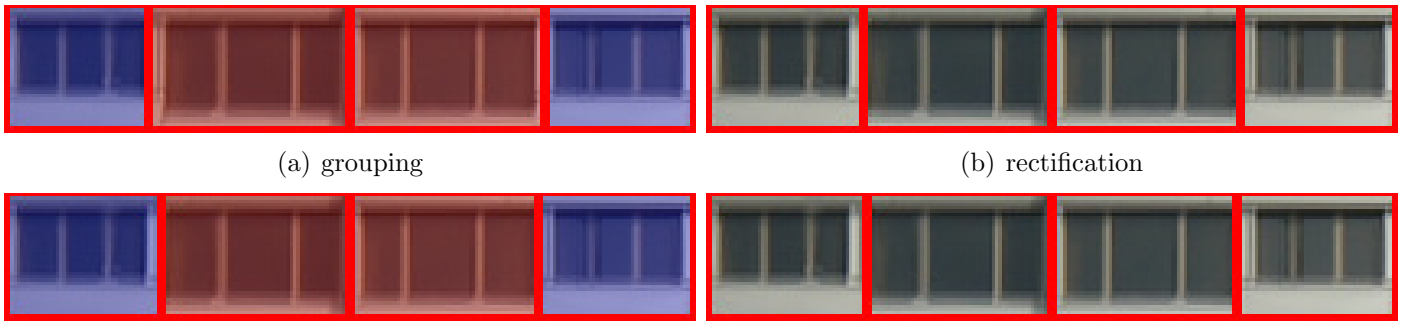
(c) grouping (d) rectification

Figure 3: Level 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

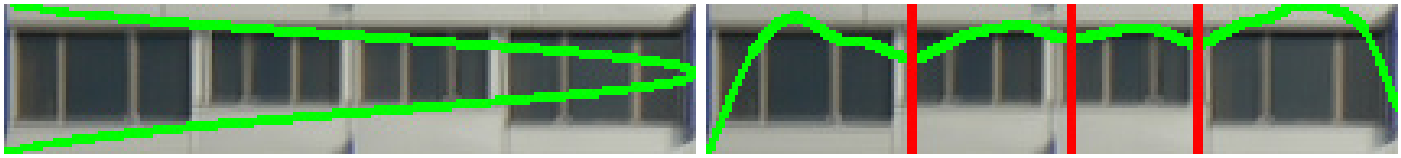
Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

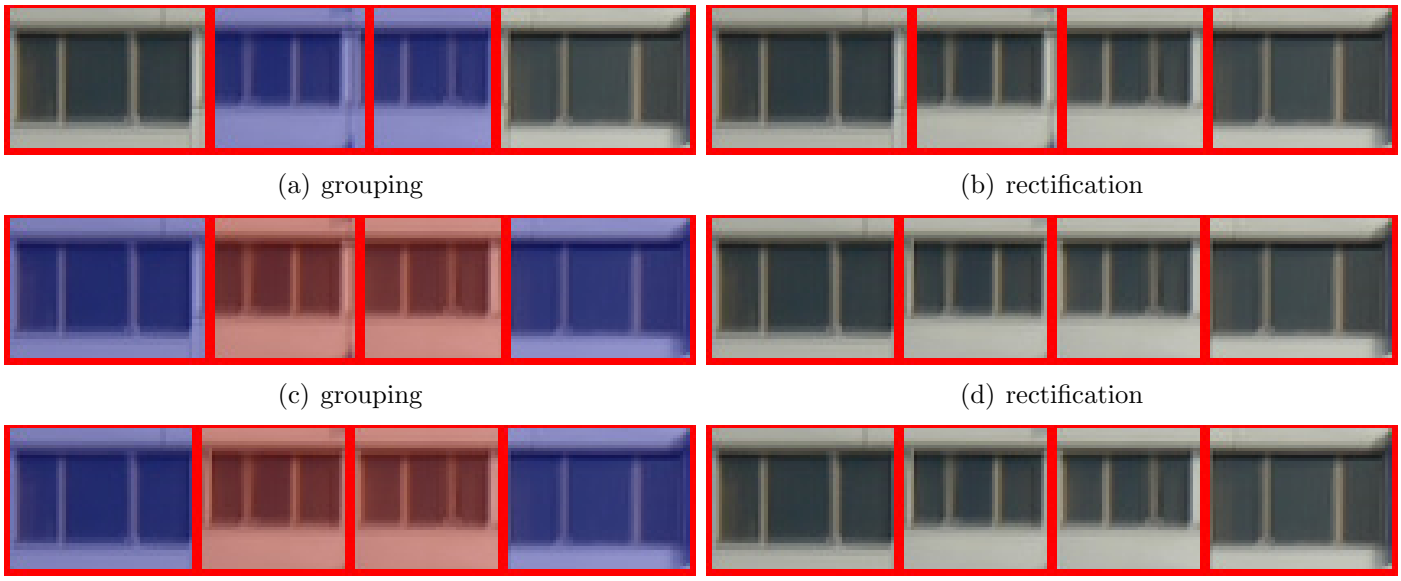
(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.



(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.

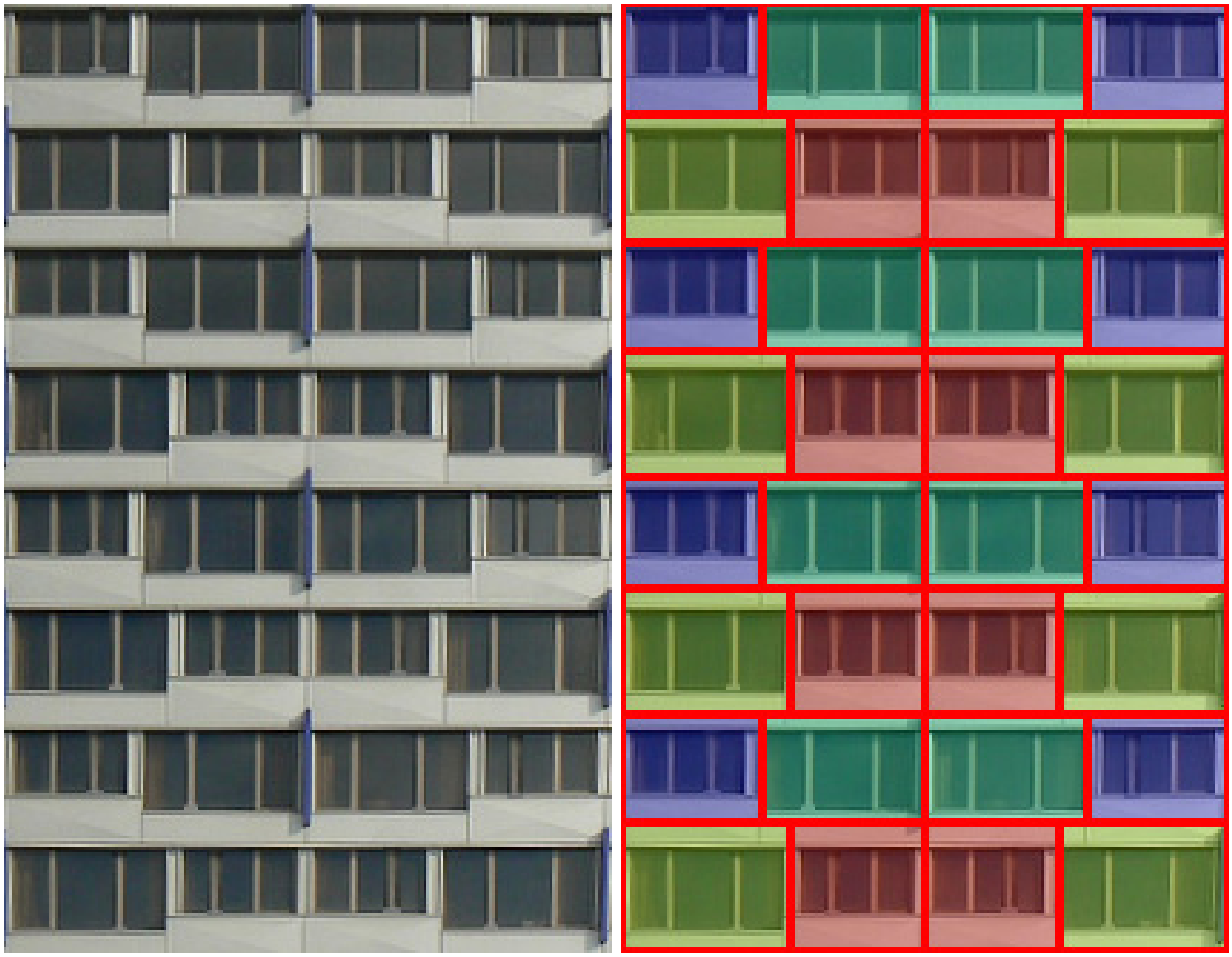


(a) grouping (b) rectification

(c) grouping (d) rectification

(e) grouping (f) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.



(a) input image

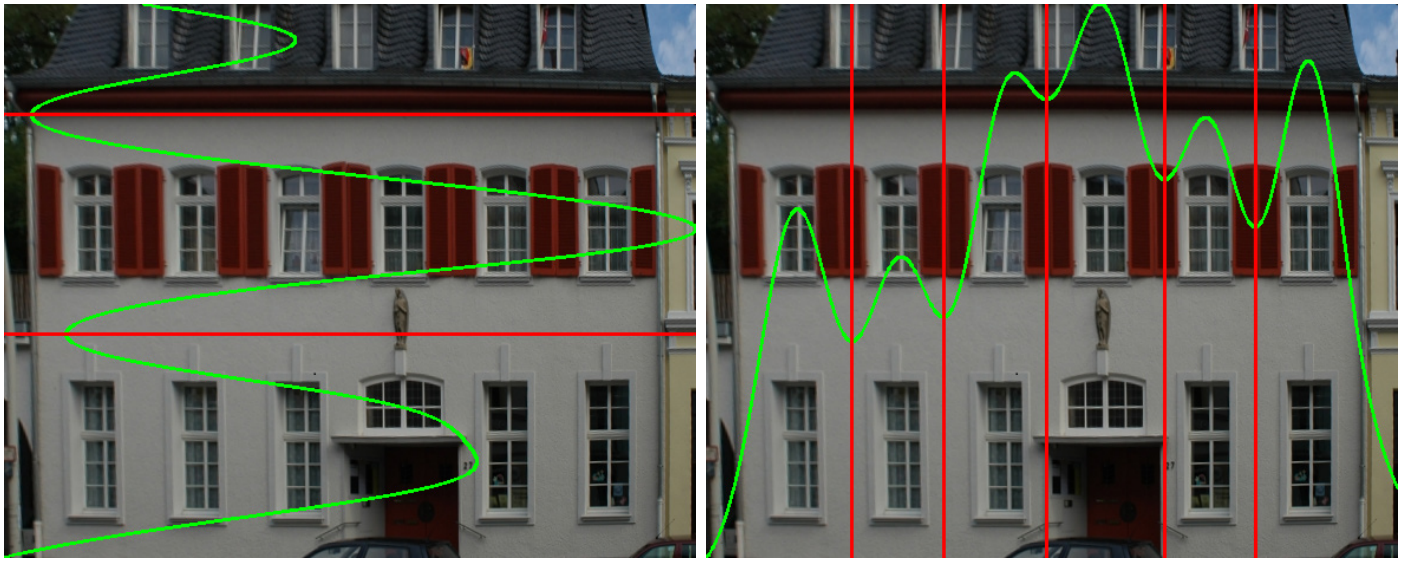
(b) output partition

Figure 8: final result

Example #09

(a) (b)

Figure 1: Input image and detected edges



(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 3: Level 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: vertical.

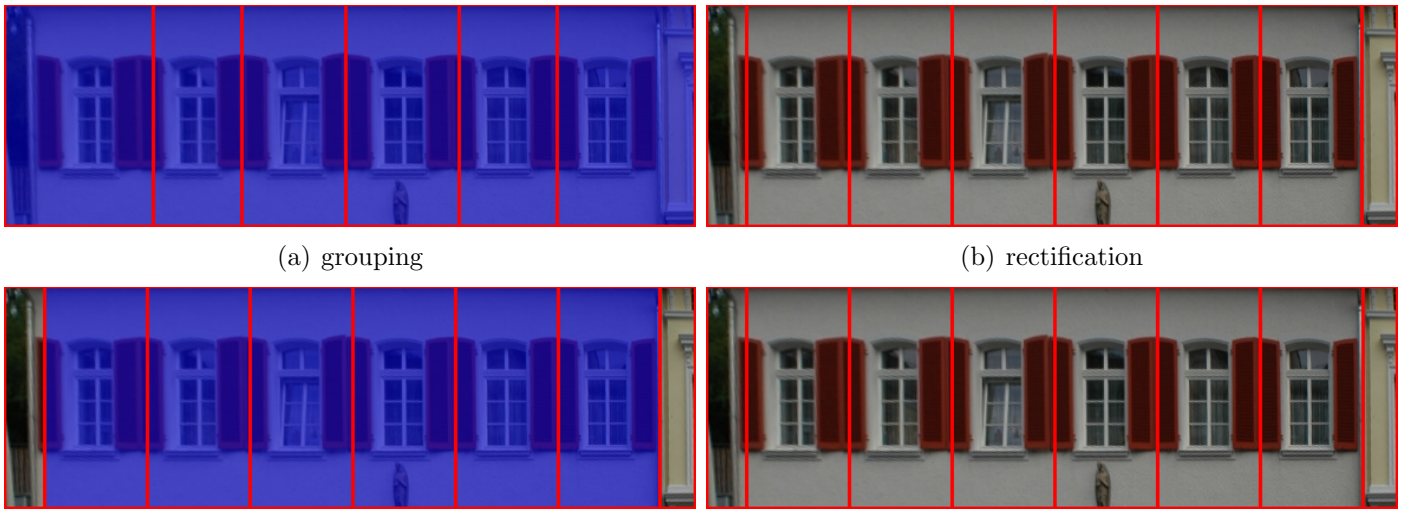
(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

(a) horizontal (b) vertical

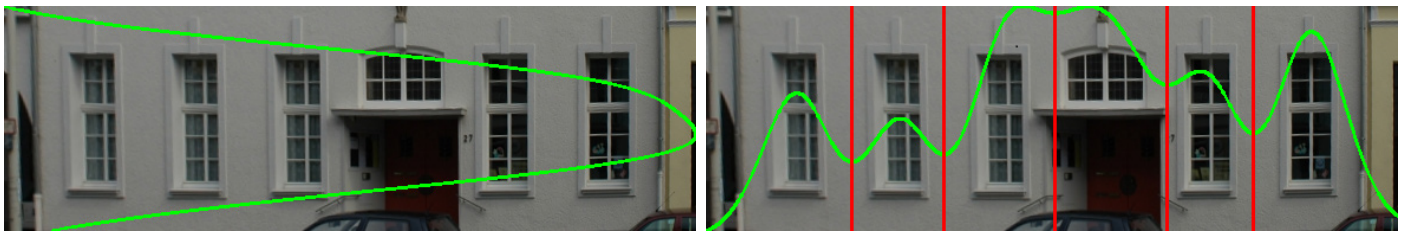
Figure 6: Level 2, group 2, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

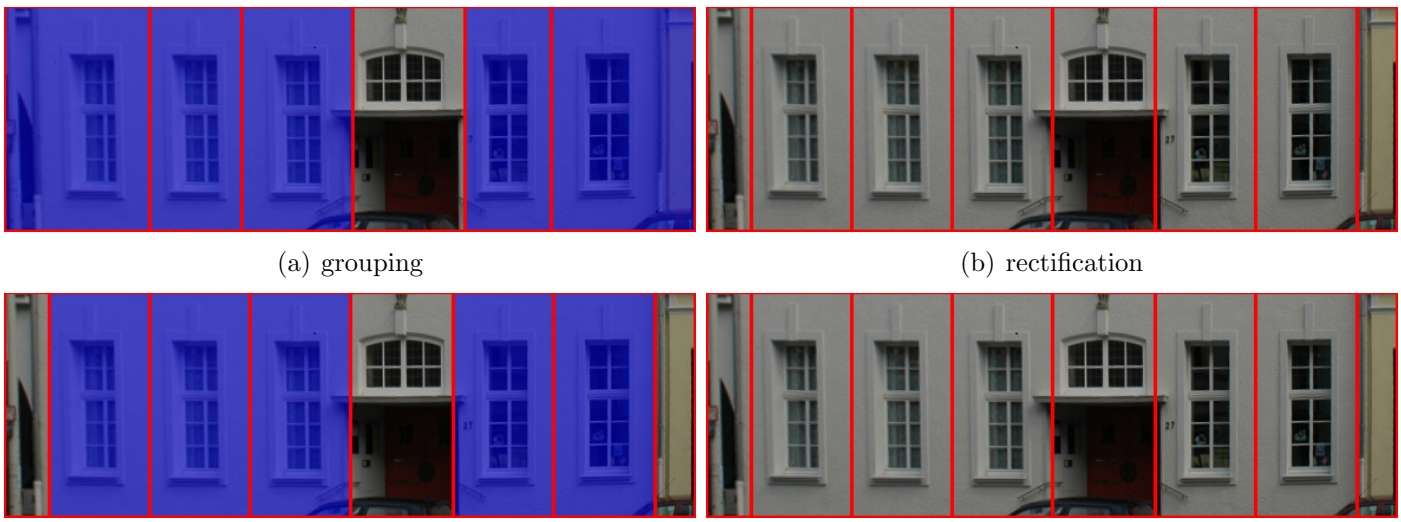
(c) grouping (d) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.



(a) horizontal (b) vertical

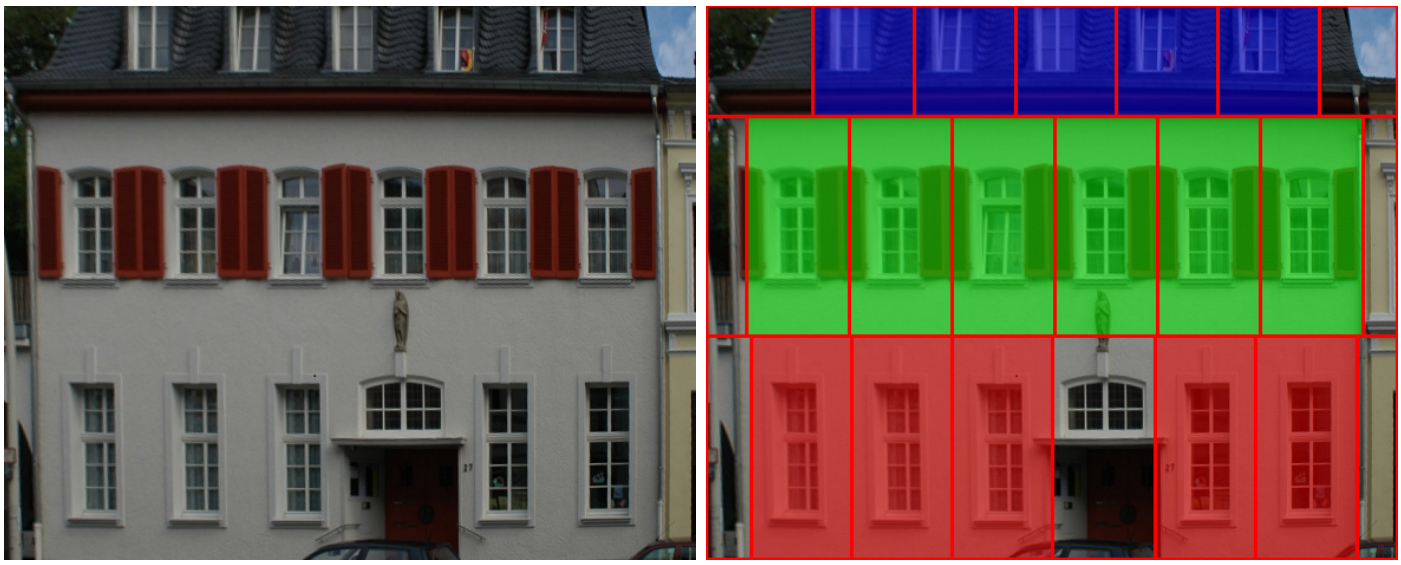
Figure 8: Level 2, group 3, penalty function. Determined splitting direction: vertical.



(a) grouping (b) rectification

(c) grouping (d) rectification

Figure 9: Level 2, group 3, iteration of grouping and rectification.

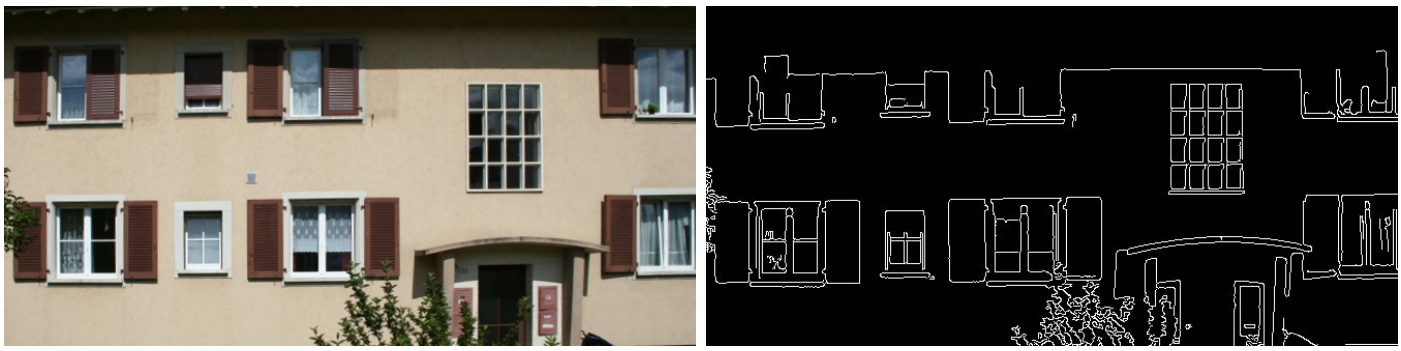


(a) input image

(b) output partition

Figure 10: final result

Example #10

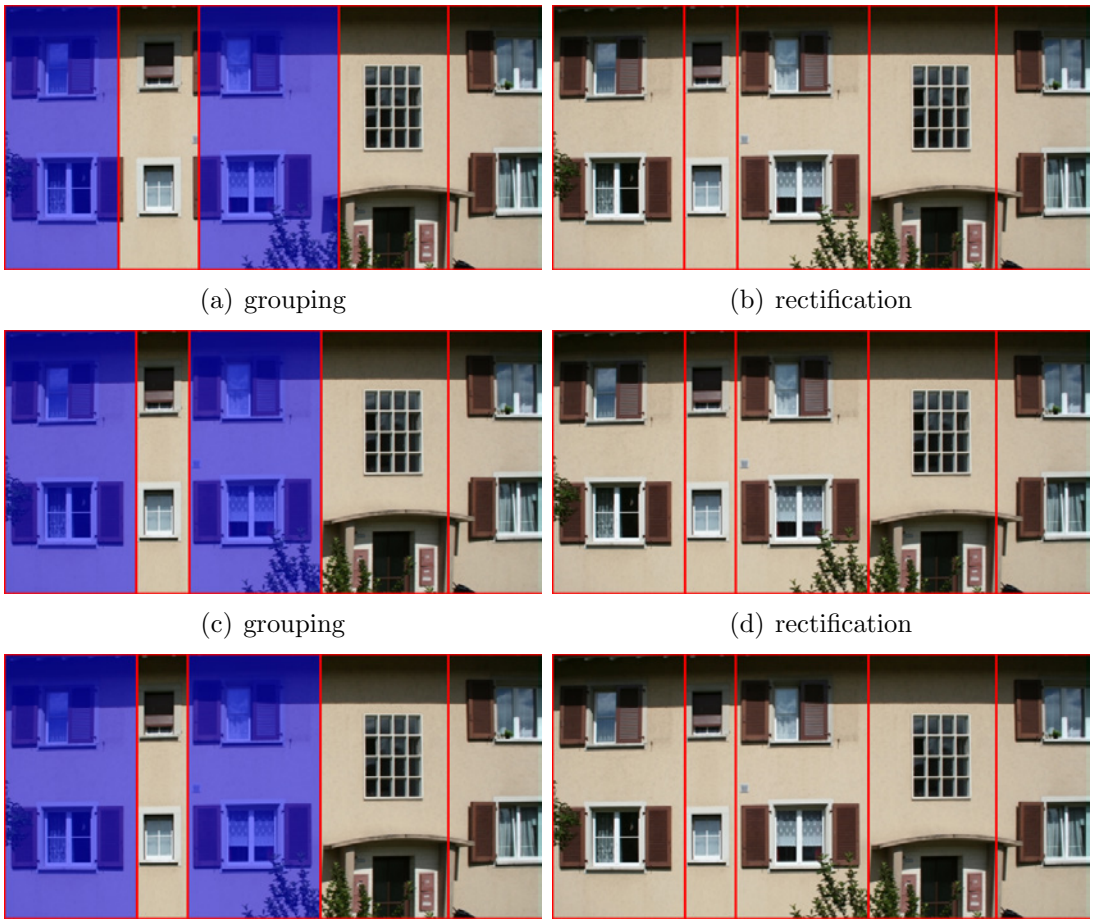


(a) (b)

Figure 1: Input image and detected edges

(a) horizontal (b) vertical

Figure 2: Level 1, penalty function. Determined splitting direction: vertical.

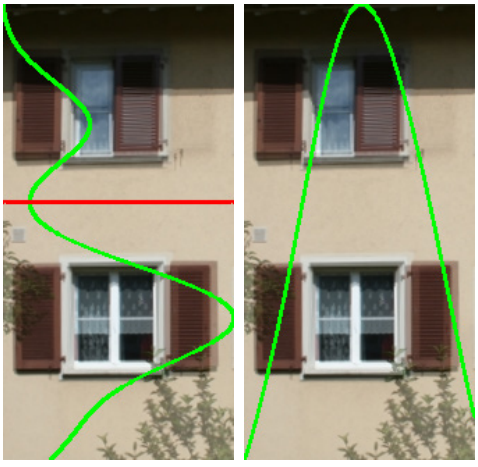


(a) grouping (b) rectification

(c) grouping (d) rectification

(e) grouping (f) rectification

Figure 3: Level 1, iteration of grouping and rectification.

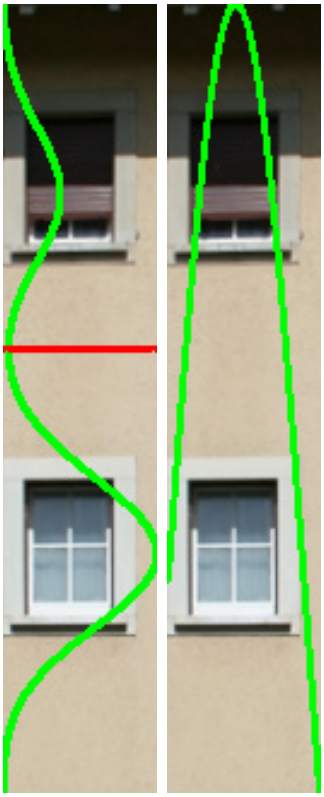


(a) horizontal (b) vertical

Figure 4: Level 2, group 1, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 5: Level 2, group 1, iteration of grouping and rectification.

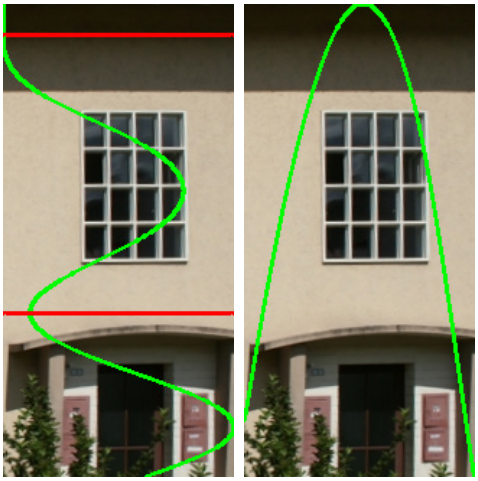


(a) horizontal (b) vertical

Figure 6: Level 2, group 2, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 7: Level 2, group 2, iteration of grouping and rectification.



(a) horizontal (b) vertical

Figure 8: Level 2, group 3, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 9: Level 2, group 3, iteration of grouping and rectification.

(a) horizontal (b) vertical

Figure 10: Level 2, group 4, penalty function. Determined splitting direction: horizontal.

(a) grouping (b) rectification

Figure 11: Level 2, group 4, iteration of grouping and rectification.

(a) input image (b) output partition

Figure 12: final result