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UL) ITS

Detection of General Obstacles on the Road by Subtraction with Past In-Vehicle Camera Images

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Abstract Recently, research and commercialization of driving support technology is an active topic. In light of the above background, we focus on a technique to detect forward obstacles from in-vehicle camera images. Most existing techniques detect obstacles that could be expected beforehand, such as a pedestrian or a car. However, there could also exist various unexpected obstacles on the road. Therefore, it is necessary to detect general obstacles. Hence, this paper proposes a method for detecting general forward obstacles on the road by subtraction between present and past in-vehicle camera images. The proposed method first absorbs the gap of the road-surface regions due to the differences of the running speed and the running position in the lane, and determines the correspondence of the road-surface regions between the present and the past in-vehicle camera images. Then, the proposed method detects obstacles by subtracting the corresponding road-surface regions. Experiments were conducted using actual in-vehicle camera images. The results show that the proposed method could detect obstacles on the road accurately by subtracting the present and past in-vehicle camera images. Moreover, it was confirmed that the distances to the detected obstacles were large enough to avoid the obstacles while a vehicle runs at a standard velocity in an urban area.

Key words Detection of obstacles, In-vehicle camera, Subtraction, ITS

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2.

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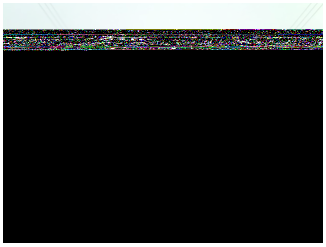
1 Google http://maps.google.co.jp/



f_{t_0} $g_{t'_0}$

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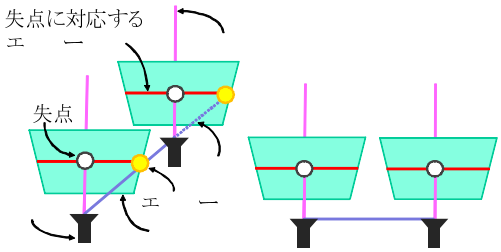

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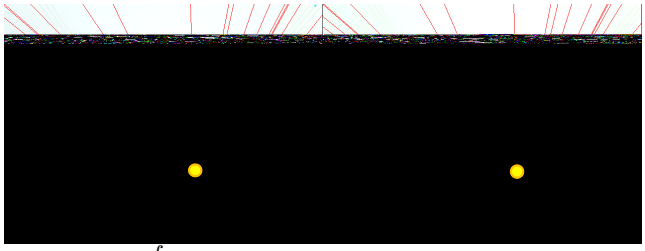
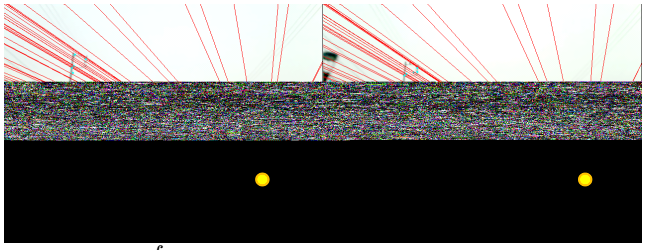
2 1 wwSw)–h



y f_{t_0} $g_{t'_0-6}$



f_{t_0} $g_{t'_0-3}$

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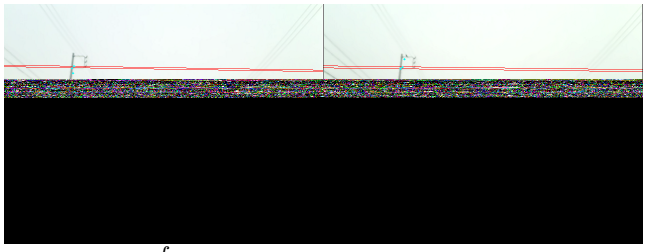
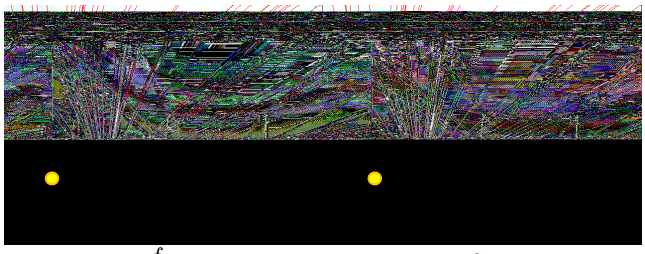
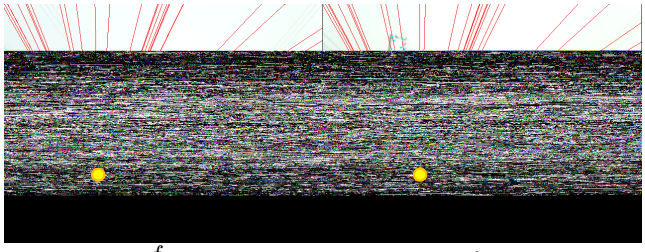


f_{t_0} $g_{t'_0}$



f_{t_0} $g_{t'_0+3}$



f_{t_0} $g_{t'_0+6}$

: :

5 7SUMfww

2 fiwffd

fiwh $R = f(x,y)g$

$f_{t_0}(x,y)$ tff0bawLff

wh $g_{t'_0}(x',y')$ q

(2) tmMo (1) pff0 h tSMo

ffwMtfffitqwL

ffwh $f_{t_0}(x,y)$ qawL ffwh

$g_{t'_0}(x,y)$ w)tUbqxfip

1 t (1) pff0h 2 tff

fwwfiSffw)hw

bwtffwMtQwcUff

b

fipxwffJrUb

fiwrgq 3 tbrg

qwItmMo

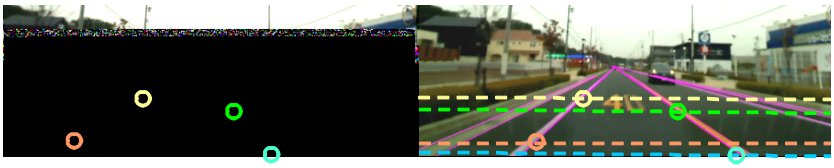
3.1 ww

aw w

t c w w t_0

$f_{t_0}(m,n)$ tff0bawLffw

$g_{t'_0}(m,n)$ fg AUfpq



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6 w0:

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tMqVx 2 mwwffUtMr
wffxfi:TTqUT
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jfiSUM qfw w w
wffhhw 5 tbT 2
wmtaowffUfib
qUfipV
Tqqawww
ffqhffwfi:wffw x
DP m
wff (e_x, e_y)hffwfi:wff
(v_x, v_y) qbq f_i g_j $p(i,j)$
x (1) p

$$p(i,j) = \frac{1}{je_x - v_xj + \alpha} \quad (1)$$

p α *xpf* $P(0,0) = p(0,0)$
q=

$$P(i,j) = \min \begin{cases} P(i-1, \quad j \quad) & +\text{y } \omega_1 \cdot p(i,j) \\ P(i-1, j-1) & +\text{y } \omega_2 \cdot p(i,j) \\ P(\quad i \quad, j-1) & +\text{y } \omega_3 \cdot p(i,j) \end{cases} \quad (2)$$

6fit-bp $\omega_1, \omega_2, \omega_3$
00
(i,j) w%UqqawLffw
wff0b
wffxqqawwff0
fi: SIFT fiff [13] Mą RANSAC
[14] Mofibqph
ffwfi:w2txUwM
MoMqfiwffwffM
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UDfip

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3. 1 pff0hfftxffw
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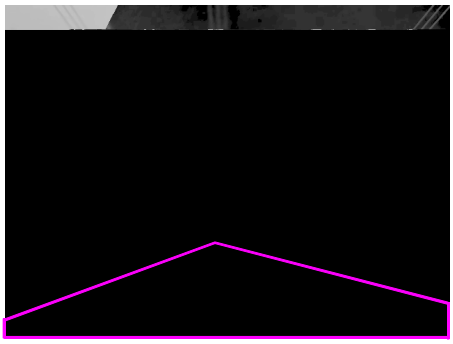

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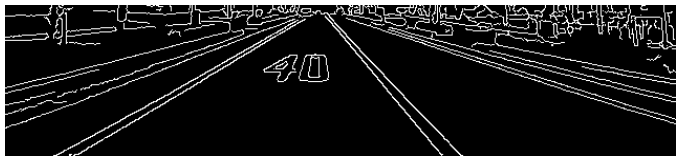

OwLw

OwwawwOh

8 hwtd

sMwcUObfwhOwL
wwKh $f_{t_0}(x,y)$ tff0ba
wLffwh $g_{t'_0}(x',y')$ AU
fpUff0fitvfifiw
Qfiotloffdm
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fiwfiw 4 ff0fi:UAqsTfi
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sfiSpff0fi:qUpVsMDfiQU
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8 tbUqwLffw
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3. 3 wt

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ow

3. 3. 1 wt

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4.

4. 1

4. 1. 1

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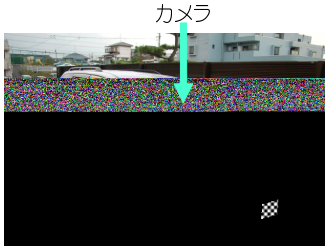

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oMqUTh 10 w 9
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4. 2. 2 wA

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to wta
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gt 11(c)
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qxUUCbwpUU
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(a) U *d* (b) U *d*

(c) U0 *d*

11 m *d*

12 Twm *d*

1 UptUp

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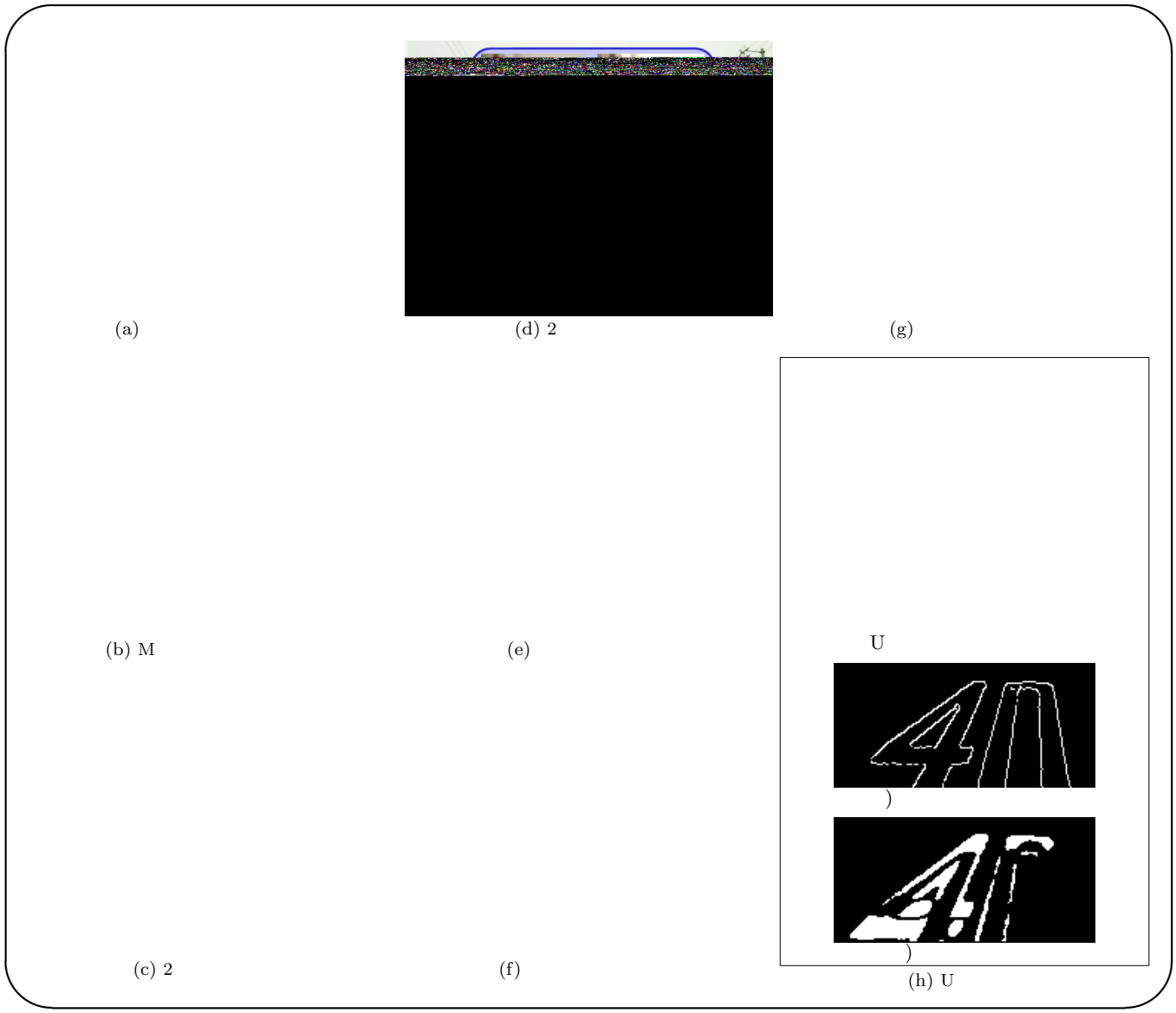

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