

Words for 3-D Vision

Nie Shicong

June 9, 2020

Contents

Linear Algebra Done Right	1
1 Chapter 2 & Chapter 3	3
2 Chapter 4	4
MVG Lecture 8, 9, 10	5
3 Chapter 5	6
4 Chapter 8	7
5 Direct approaches for Visual SLAM	8
6 Chapter 11	8
7 Review	10
8 Introduction to Linear Algebra	10
9 Toefl Listening	11
10 Miscellaneous	14
11 slam	36
12 Introduction to Algorithms	48

Linear Algebra Done Right

audacious
torturous
banish
make up for ...
in a fasion
genuine / formal
, due to the next class

without charge
I'm no longer around
first brush
immerse yourself in ...
an emphasize on attaining ...
zip through a page
on your part
ponder
internalize
without regard to ...
owe a debt
heritage
antiquity
Bestowing proper credit on ...
undertake
In no case should ...
dispense with
clutter
vague
as rigorously defined as
philosophy
lurk
proposition
corollary
once and for all
be enlarged with
triplet
transport
paralelepiped
Roughly speaking, ...
anticipate
derive / derivation
refer to ...as ...
instantaneous / spontaneous
be doomed to ...

1 Chapter 2 & Chapter 3

rudiment / rudimentary

In a broad figurative sense

frescoe

mosaic

landscape

It's no coincidence

proficient

matter

vibrant

compelling

rather sophisticated

indicative

portray

graph

irradiance

by no means trivial

diffraction / refraction / reflection

germane

we can argue with

emit

cone

negligible

undeflected

upside down

subtend

radiance flux

consist in ...

compensate

...outlined above

...thus obtained

articulate / articulation

aberration

counterpart

2 Chapter 4

reconcile
at the outset
moreover
discern / discernible
presumably
photom
discrepancy
corrupt
manifestation
counteract
envision
opaque
suggestive
cardinality
count on ...
conceive
rephrase
lend itself to ...
lump
departure
scatter
ambient
translucent
anisotropic
commonplace
hint
How do we proceed ?
ill / well posed
an abuse of notation
tilde / wiggle
identical
more diagonally
moderate
nonuniform
, irrespective of ...
...made of ...

regard ...as ...
decent
curvature
marble
distinctive
elucidate
extended
qualitative / quantitative
diffuse
warp
substantial
prune (out)
pyramid
jerk
whilst
shearing
field
even if
chameleon
specularity / specular
among other things
mega
heuristic / heuristics
discriminate / discriminative
mannequin
dummy
doable
stroboscope
agenda
alternate among / between
side benefit / effect

MVG Lecture 8, 9, 10

fascinating
pursue

schematic
involved
suboptimal
haunt
recipe
reasoning
inference
pathological
chances are that ...
reminiscent of ...
...mingled with ...
derive / derived / derivation
bombastic

3 Chapter 5

unveil
photogrammetry
Without loss of generality / continuity
characterization
sufficiency / necessity
draw attention to the case that ...
three out of the four ...
parallax
exercise caution to ...
be of more significance for ...
bury
uncontroversial
universally accepted
probable / improbable
When combined with, ...
In what follows, ...
oversight
In the remainder of ...
multimodal
optimality

4 Chapter 8

panoramic / panorama

at most

taxonomy

gross errors

pertain to

thesaurus

suspicion

be promoted by ...

quadrilinear

annihilate

quadruple

clarify / clarity / for clarity

rectilinear

glimpse

perturb

synthesis

concave

crank up

isoline

asymptotic

be inferior to

zig-zag

contract

paraboloid

provided (that)

in this regime

revert to

profit from

extremality / extremity

quasi

damp

overlook

be (all) set to go

silhouette
contour
a whole lot
monocular
footage
circumvent

5 Direct approaches for Visual SLAM

invariably
devastate
deteriorate
degrade
nuisance
sideways
close by
soap films
in-between
revision
residuum / residual
voxel
more or less
alleviate

6 Chapter 11

multifaceted
irregular
polygonal
so as to ...
convolve
forcibly
suppress
tile

disparate
elaborate
contrast
sawtooth
aliasing
sinusoidal / sinusoid
convey
transmission
adequate
waveform
ego-motion / ego / egoistic / egoistical
primitive
multiscale
superpose
be similar in spirit to ...
compromise
macroscopic
rationale
caveat
radically
forego
laden
be reputed to ...
putative
orphan
underlying
be free of ...
handful of ...
render sth. be
settle for sth.
set up
two orders of magnitude
uneven
play with ...
in place of ...
extrapolate
convex hull
carve

tetrahedra
prism
arch
surfaces of revolution
bookkeeping
entail

7 Review

long known
indispensable
rational / rational number
quotient

8 Introduction to Linear Algebra

all-important / vitally important / crucial
hammer away at the difference between ...and ...
...back off from ...
seesaw / teeterboard
spreadsheet
This is more than ...
at once / at the same time
stand for ...
either way
humble
fall into place
The odds are ...
basic facts
regard ...as ...
common sense
magician
sweep
provision

subroutine
abnormal

9 Toefl Listening

folk / fairy tale
act out
narrate
props
scenery
be disillusioned with
be grappling with
symbolize
seemingly
unsolvable
turmoil
bare
...be a departure from ...
make us see
be swept up
I'd love / like to ...
...be the same ...as ...
the significance difference is with ...
costume
...be teeming with ...
organism
...get as much popular attention as ...
whale
microscopic
algae
...aren't as exciting
bulk, bulk of ...
plankton
fresh water
mystery
not the way birds do

must
commute / commuting
stimulus / stimuli
sun's rays
barely
penetrate
away from
sunlight
head back toward ...
illuminate
expend
predator / predator avoidance
Make sense, doesn't it ?
But what do we do with ...?
at great depth
light up
bioluminescent
despite all these
by sight
presence and absence
prey / prey on
ultra-violet
conserve
feeding
digest
archaeology
go out into the field
shovel
an array of
inter-disciplinary / multi-disciplinary
muon
...result from ...
subatomic
start over
basically
proton
zip through
outer space

be critical for ...
be closely based on ...
occasionally
hardly ever ...anymore
originally
controversial
filmmaker
purity
over time
orchestra
if wanted
drum, rolling of drums
...or whatever
But that wasn't as common
..., the ones concerned about
Trouble is(was), ...
the luster wears off
commerce
was it ever ?
the commercial types
now that ...
visual medium
stage
straight adaptations from ...
since ...
all they pretty much did was ...
on the mark
nonsynchronous
expressive
have experience with ...
live radio
technician
...that makes sense to them
less obvious
Anyway, ...
look at this in various ways
radical
advocate

a bit of an exaggeration
What meant to say was ...
making money
proliferate / proliferation

10 Miscellaneous

striving / strive
grand goals
core mission
non-profit
fuel ...
openly
sponsor
editorial publications
across the world
workshop
panel / panelist
webinar
mailing-list
newsletter
disseminate
more collaborative / inclusive
have sb. on-board
curate
advisory board
enthusiast
at scale
alchemist
predictive maintenance
schedule a meeting / call
quota
coffee break
poster
interface a new problem with ...
peer, peer review, peer pressure

be articulated in two phases
announce / announcement
adherence to .../ adherent
final aggregation score
ever more
exclusively focus on ...
memory overhead
take / draw inspiration from ...
disentangle
a surge of
mediate, be mediated by ...
neurocognitive
sensorimotor
remain a long-standing challenge for ...
...factor in ...
curriculum
progressively / progressive
over long time spans
interfere with ...
abrupt / abruptly
excel = be master of .../ excel at ...
a batch of
pragmatic pragmatically
hinder
methodology
developmental
in scenarios of ...
timely
refine / refinement
on the basis of ...
mammal / mammalian
throughout the lifespan
contingency
sustainable / sustainability
sustained = continuous
neurophysiological / neurophysiology
visiting student
eligible

democratic / democracy
...be made possible with / by ...
consultant
lineup
given
on a daily basis / on a regular basis
cutting edge
underway
initiative
hub of information
didactic
avalanche
with ...in mind
value ...
showcasing
venue
cause
bibliography / bibliographic
hiccup
antithetical
antipodal
utterly
nerve ...
bombard / be bombarded with ...
arrange = lay out
as originally conceived
living creatures
be adept with ...
repurpose
in some ad hoc way
dispute
in any case
self-imposed
submarine
harness the power
towards its own purposes
steer
accrue

brilliant, a brilliant idea
metaphor
corollary
teleoperation
rebel / rebellion
be constantly changing / evolving
regularity
a rough idea
string
transpire
unfold
at its own pace
prose
sensible
unorthodox
peg, pegged to ...
entrust
probe
waterfall
definitive
cascade
tailor, be tailored to ...
diploma
cohort, a diverse cohort of ...
attest / attested
defer
transcript
comparable
proficiency / proficient
postsecondary
ivy
a huge time commitment
rigorous
embark
accredit / accredited
phenomenal
in no way
disrupt / disruption

breadth
demonstrated leadership
deposit
flush
await / be awaiting
turtle / tortoise
carnivorous / herbivores
imperative
pervasive
scavenge / scavenger
refrain from ...
scarcity of ...
sensitization
habituation
exposure
a well lit room
reciprocal
retreat into ...
secrete
ion
astounding
finer
acuity
causal / casual
differentiate
conditioning
be made famous by ...
saliva / salivate
..., as such in the example of ...
cattle
deter ...from ...
in the wild
uncover
inhibit / inhibition
octopus
jar
crab
...trapped inside

hint at ...
...be paired with ...
fade away / out
renewed
embrace
malleability
regulate
compensatory
homeostatic
hippocampus
neocortex
human subject research
the vast majority of ...
modality-specific
ecological
multisensory
embody
in one's infancy / infant
stepping stone
ad-hoc
astonishing
assimilate
rehabilitate / rehabilitation center
modulate
overarching
predominant / prominent
profile
grant
seminal work / seminal fluid
ocular
newborn
kitten
deprivation
...be characterized by ...
...with the aim to ...
comprise
replicate / replica / replicant
neuroscience

finding
preferential
transient
amend
be contingent on ...
should / if
usher
interleaved
in favor of ...
graceful
richness
long-standing
mitigate / alleviate
...to make sense of ...
be immersed in ...
spatio-temporal
make massive use of ...
reservoir
opt, opt to
plastic / elastic
embed / embedded
intractable
surrogate / surrogate mother
mutable / mutation
...in response to ...
accommodate
enforce
vanilla
resemble
plausible
habituate to .../ habituated
these results reinforce that ...
...be accounted for
interplay
episodic
rehearsal
cause-effect
ambiguous

revise
spontaneously
a wealth of ...
crossmodal
schematic / schematic view
valuable
intricate
dictate / be dictated by ...
staged
bootstrap
tutor / tutoring
unveil
disclose, disclose the cause
bilateral
innate
deceptive / deception
scaffold
exogenous / endogenous
be congruent with / congruency / congruent triangle
perceptual
bind
causal inference
stationary
disregard
radically
over the course of millions of years
underpin
evolutionary
in-silico
As a consequence = Consequently
inspiration has originated more strongly from ...
acronym
genetic
...take place as ...
ambitious
...derived from ...
arguably
set the stage for ...

a remarkable increase in ...
dedicated
...than in the past
resonate with the readers / resonate
touch upon
in the remainder of ...
with the intent / intention to ...
make-up
manifest / manifestation
blueprint
zygote
nurture
cultivate
be now more aware of ...
highlight the importance of ...
deceive
make no pretence of ...
diversity and inclusion
open-ended / open-endedness / open-ended questions
pathway
an alternative to ...
empower
synergy / synergy effect / in synergy
statics / dynamics
conducive / be conducive to ...
reside
delegate
foster
cope with ...
genotype
aspiration
resurgence
synopsis
speculation
pillar
In essence = Essentially
...in light of ...
bloom

around 2019
shift
It's not after long that ...
bet on ...
masterfully
expertise
neat
be indebted to sb. for sth.
pickle
customary / customarily
brevity / clarity
wit
perturbation
mastery
neglect
performant
ingest
comply with ...
trademark
aforementioned
malformed
blob
glob
a patient is admitted to the hospital
administer drug
concerned
relative
a sick thought
not uniformly understood
moderately
be wrong in ...
subjective belief
a rational person
conscious, make conscious use of ...
inner-held
...be judged to ...
dwell (further) on ...
philosophical issues

strike a balance
outgrowth, an outgrowth of ...
involvement in sth.
attend a course
span the entire spectrum
Accordingly, ...
In this spirit, ...
sketch
otherwise
stand in the way of ...
attentive
conditioning
omit / omission
recitation
elsewhere
simplicity in exposition and sophistication in analytical reasoning
a rich set of ...
go into debt / be in debt
acknowledge
be thankful to ...
Last but not least, ...
take sth. (it) as a given (that ...)
a short review about ...
antiquity
at the outset
toss, a coin toss
a die roll
conceivable / conceivably
excerpt
in accordance with ...
collective
immediately obvious
underlying
Strictly speaking, ...
pathological
dart, throw a dart
qualify
constitute

successive
identify
namely
downstream, ...downstream from ...
For example; As another example
Proceeding similarly, ...
predede, preceding
settle on ...
by necessity
counterpart
...differ from ...in that ...
spin
...hinge on the fact that ...
incidentally
legitimate / legitimacy
tractable / intractable
Invariably though, ...
inscribe / inscribed
equilateral triangle
millennium
game of chance
touch upon
lay a / the foundation for ...
raise the standard
rigor / rigorous
influential
axiom / axiomatic
pervasive / pervasively
...in conjunction with ...
traverse / traversal
be inferior to ...
a much discussed problem
stick to / adhere to / insist on
under this strategy
celebrated
...amount to ...
malignant / benign tumor
a common first thought

aircraft
...state that ...
In words, ...
subsystem
subinterval
...consist in turn of ...
populate, be populated with ...
dial up
modem
the probability of interest
facility
facilitate
combinatorics
in principle
thought
a large portion of ...
desired
consecutive / contiguous
cardinality
algebraic identity
instrument / instrumental, instrument readings
two raised to the fifth power = two to the fifth
a notion of
associate with sth. sth.
focus exclusively on ...
qualifier
a lot of new ground
the general line of development
genuine / genuinely, genuinely new
give rise to a value
In what follows, ...
...in place of ...
throughout
conceptually straightforward
range over ...
By a similar argument, ...
...is through ...
characterize

be either for or against ...
For all its simplicity, ...
...be sketched in the section 3
Note that here and elsewhere, ...
the coin comes up a head with probability p
prior
refer to ...as ...
..., specialized to ...
come up for the first time
be monotonically decreasing with ...
misspell
typo
...be well modeled with ...
justification
It is often desirable to ...
monetary reward
...in proportion to ...
a weighted average of ...
As motivation, ...
anticipate
roughly equal to ...
dispersion
pitfall
It is not generally true that ...
at a speed of ...
...is obtained by nothing that ...
prototype / prototypical
attempt, attempt to
coercible
resist
be evolving
I'm still not done learning
set up a structure for ...
...as I see it
elaborate upon ...
groundwork
one thing that initially surprised me was ...
...come into play

There is no one right way to ...
methodical / methodically
linguistics
field of study
rhythm / melody
keen
modular mind
vocal, vocal awareness
chunk
first-hand
unconventional
intonation
stick
clap
consonance / dissonance
palate
most of the time
muscle / muscular
youngster
stick out / stick way out
dark is drawing in
cavity
nasal
to name a few
look up ...
make sb. sure
check out ...
go over ...
due to a difference of opinion
homephone
make a phone (call)
repeat out loud / practice out loud
drill ...
you won't transform overnight
dedicated, be dedicated to ...
singleton
bisect / bisection
timezone

polaris
anagram
palindrome
congestion
pertain, pertain to ...= belong to ...
universe
In the same spirit, ...
be destined to ...
...argues in favor of ...
regardless of ...
flaw / flawed
to some extent
paradox / paradoxical
scrutinize
a great deal of information
Roughly speaking, ...
devil / devilish
quirk / quirky
testament
a general agreement between intuition and what is mathematically correct
...extends naturally to the case of ...
imperative
dialog
weave / weaver, be woven into ...
restraint
budget
Over the past three decades or so, ...
purgeable
bump
synergy
affordance
induce
worthwhile
As machine learning is maturing, ...
formalism
toy / non-toy problem
plague, be plagued by ...
reinvention

induction / inductive
speedometer
insightful
...be called for
In any case, ...
cf. = confer
Graphically, ...
gambler
anticipate / anticipated
for the time being
light bulb
burn out
elapse
meteorite
Sahara desert
..., be it through .../ Be it through ...
staircase form
line of argument
a case in point
in point of ...
Loosely speaking, ...
snowfall
celebrate / celebration / celebrated
conclude
corrupt
...parallel ...
In complete analogy with ...
vicinity
needless to say = It goes without saying that ...
needle
mark the origin of ...
a surface is ruled with lines
line segment
acute angle / obtuse angle
midpoint
justify
the remaining time up to completion
metro (train)

metropolitan
board the train
be analogous to .../ in analogy to .../ an analog of ...
...carry over to the present context
schematic
It suffices to ...
The converse of this statement is also true
stencil / template
chromosome
bilingual
in a row, 7 days in a row
versatile / versatility
variability
interlinked
in the vicinity
but they still can't rival homo sapiens for complexity
proposition
be agnostic to ...
they can be advantageously combined
better off, better off alone / better off without ...
nuisance, nuisance variable
latent variable
preclude
resort to
causality
neat / neatly
punctuation marks
unleash
I find them severely wanting in abilities
arsenal
divulge
ideology
triumph
..., but that wasn't always the case
proceed in chronological order
hype
extravagant
publicity stunt

clip
cardinality
a means to an end
It's almost exclusively used for visualization
By itself this isn't very useful, but ...
genre
be akin to ...
induce
spark a great deal of interests
lately = recently
In the past this was all but impossible, ...
in complex learning regime
endorse / endorser / endorsement
amortize / amortization
resume membership
intra- / inner-
episode / episodic
hallucinate
assortative
resilience
discriminate between ...
confine, be confined to ...
a multitude of ...
...outperform ...by a significant margin
...be nigh
grace / graceful / gracefully
a gentle introduction
clarify the relationship between ...
myth = a commonly believed but false idea
cont. = continued
synthesis / synthesize
digest
compositionality = hierarchy
coefficient and intercept
mainstream models
an emerging line of work
cast ...as ...
In the same vein = In the same style of speaking or writing

attenuate = weaken
 alleviate
 meliorate its effects
 rife, be rife in ...
 discriminate specific tasks
 conceived
 mitigate, mitigate the risks
 commonality
 the unified definition of ...
 backbone
 acyclic graph
 thesaurus
 proactive
 lockdown
 oat
 sportsmanship playing field therapy dialect stub negate / negation / negative
 ...with the Bayes normalizer made explicit truly autonomous robot without
 human supervision comply with ...blueprint from scratch hard-pressed com-
 petence / competency sheer, sheer size There's no point doing sth appreciate,
 appreciate that it's difficult to ...at stake, This example gives a good flavor of
 the problem at stake the main utility of ...audit scaffold front-matter excerpt
 amend favicon verbatim reclaimable delineate ordinate booklet coordinator
 installing manifest presumably ethnicity pathetic malicious heartbreaking be
 singled out victim merit pandemic furious people are in high spirits circu-
 lation racial discrimination paranoid precaution blast out rule people with
 iron fist agenda protest set the title of the video as a clickbait skyscraper
 footage invocation well-gearred, they're geared towards different things grace-
 fully puddle Very likely there are errors hue be endowed with ...in the same
 vein It is primarily used for ...the function under consideration recast axiom-
 atize inscribe a hilly terrain It can be loosely thought of as ...Likewiseas
 thought they are ...methods that are specially tuned for ...spur, It was their
 use that spurred the development of ...fallacy gambler judicious ...in question
 = ...being discussed preconditioner filtration The distinction consists in the
 change of the majority of real operations by the corresponding complex opera-
 tions deviation unconditionally They are hardly ever used viz secant damped
 method stuck at ...denominator / numerator flutter As regards ...risk to do sth.
 certify ...predates ...by 3000 years wiggle circumvent, the problem is circum-
 vented with the twofold aim of ...the problems fall into two categories conic

intervention designate extraneous confound concave / convex These differences must be considered whenever the solution to a nonlinear least squares problem is being sought intercept a fully worked out example fluctuation To the right is a plot illustrating ...parabolic / parabola / paraboloid rearrange / rearrangement It's cost-prohibitive and time-consuming veterinary census circumflex qualifier bull's eye grossly clustered / dispersed preclude idempotent reciprocal concentric elliptical expedient extremum / extrema attain stipulation keep ...from being too short stringent restrain Varying these will ...adhere rationale the model is in good agreement with the data regularity the cut-off value This algorithm interpolates between A algorithm and B algorithm uninformed gratification contract, the region is contracted operationalize, It operationalizes "too far" as follows monotonic pathological evident without the agonizing pain be regarded as ...computational burden ...thereof enormous de facto anticipate pedestrain legacy style It is preceded by ...versatile primitive ...at the forefront of 5G technology be way ahead of ...The USA is quite a distance behind China on 5G technology canal waterway fairytale, arriving here is to step into a fairytale cape inhabitant afterlife blossom, the cherry blossoms peaceful We were somehow talking without speaking the same language backdrop alleyway inn hostel breathtaking We have no clue what's going on like why ...authentic Unfortunately, the weather was not cooperating acrobat show Terracotta warriors the research base of giant panda breeding They work up the nerve the say hello selfie, These girls are keep snapping the secret selfies with us performant asteroid It is rarely the case that one starts with the exact and complete formulation of the problem that one is trying to solve To this end we ...ship with ...time and memory budget routine It is used for benchmarking the least squares solvers at scale irrespective of ...crucially, crucially important refer to ...as ...a trivial problem grant ...I have no idea at this point This answer is on the mark qualifier invoke / invoker / invocation synopsis prevent heaps and stack overflows from overwriting it hassle a good start to ...a cure-all otherwise = except for what has just been referred to Lots of memory leaks could just be carelessness in an otherwise well designed program, but more likely you have significant design issues and the memory leaks are a symptom of that If by "smart pointer" you mean "a pointer and a reference counter" then not all structures are amenable to smart pointers imperative sentence Finally, both classical methods are slow at computing partial derivatives of a function with respect to many inputs, as is needed for gradient-based optimization algorithm a specific manifestation of ...Fundamental to AD is the decomposition

of differentials take ownership of ...lest dangle verbatim tentative mutually exclusive polymorphism mandatory dictate, be dictated by ...oblivious digest perturb / perturbation be specialized to ...restore facility, It offers the same facilities of ...a problem instance to this end provide means touses respectively ...and ...enlighten / enlightening intrusive, this approach is too intrusive insist disastrous overleaf unilateral / unilaterally inadvertently relinquish incentive disambiguate nominate temptation cast away ...glitch, I'd upvote this except for one glitch that ...lexical / lexically on a per file basis mutable / immutatable bookkeeping detach designate photogrammetry / photogrammetric The theory is developed for general robust cost functions rather than restricting attention to traditional nonlinear least squares. geodesy reinvent synthesis forestall misconception quantify a matter of ...screen / screening, outlier screening integrally opaque fixed quantities reciprocal diminish / diminishing elasticity unduly It fits well with ...They are capable of choosing ...themselves Classically, ...the claimed ...the unthinking use of ...presumably, ..., presumably meant to ...be resistant to ...afterwards, ...and results (should be) checked afterwards to verify their reliability It is too seldom appreciated extraordinary mask gross errors profusion, a profusion of ...There's a tendency in ...exotic articulate / articulated, dynamic or articulated models a sound methodology economical methods As the technique matures,predominates overthe same way as it ...an inevitable consequence a great appreciation of ...a rapid sketch of ...touch on ...provision / provisional, provisional recommendations cultural differences It is now quite dated viewpoint superlative plenty, plenty of .../ plentiful take sth in (one's) stride far more complicated models oblique aberration pinhole camera slide along the line complication be subject to ...unwanted homeomorphic These arise because ...delicate compound they are in principle equivalent profound / profoundly hinder excessive As examples we consider 3D points and rotations intrinsic / intrinsically comb glue / gluing doughnut pliable dimple squish stroke supposedly strip contract / contractible torus postulate interior / exterior jargon They are same up to ...immerse sphere crab ...so long as ...immediate wander bizarre inescapable, inescapable consequence grasp, grasp the idea / grasp the difference disastrous apart from ...trim, data trimming argue this at some length it is poorly understood whim, personal whim wholly, it is wholly a matter of ...the ...of choice disparate They are independent of one another intuitive appeal Many of the most notable ones are, so as ...coincide with ...It can be used in place of ...peculiar / peculiarity indifference blunder the whole basis of ...irreducible henceforth more or less footing, be on

an equal footing isotropy warp / warping nuisance owing to ..., owing to the fact that ...exceptionally accolade by no means ..., It is by no means trivial non-negligible armpit bump forefinger keystone inflection point stall overshoot assure cartography site-modelling occasionally scaling makes itself felt indirectly in several ways judicious subdivide, be subdivided into ...primary / secondary subdivision worthwhile dissection detach lay the foundation of ...In rough terms,, in much the same way that ...manifest file profound prototypical inconclusive a recipe for ...defective utmost, utmost importance a broad introduction predecessor / successor be inversely proportional to ...in lieu of ...salient, salient features instant, time instant centroid devastating delicate blob artifact attain compensate quadrant rectify undergo cue contaminate blur bilateral exemplar there is a high interest in using ...endeavor, in the endeavor of ...a compound of ...miniaturization endow ...with ...amount to ...prescribe be predicated on / upon ...mutilation corpus rigorous resort to ..., By resorting to ...celebrated ample relegate profound initiative, We have for this taken some initiatives with regard to ...opt to ...undertake, be undertaken with ...beacon spike be akin to ...alike crease insofar genus superposition authentic knob pendulum reconcile detour compact / paracompact sneaky denumerable stereographic projection instantaneous detour polyhedron compatible kinship orbit shed light on ...elucidate profanity Dihedral congruence thrill exposition retraction numerator / denominator agglutinate improbable compendium punctual axial velocity longitudinal velocity / lateral velocity

11 slam

make it free of noise
 prolific
 propeller
 proximity
 sloppy
 rail
 it deviated from its path
 diameter
 get drift to one side
 by-product
 azimuth
 lawn mower

compromise
surveillance
reef
reefer
archaeology / archaeologist
ceiling
infrared
showcase
conduct the project
proximity, proximity sensor
joystick
revolution, revolution of the wheels
...same holds for ...
sketch, a sketch of ...
successive iterative process
it happens from time to time
...prevail in the domain of ...
volumetric representation
there is no way around ...
geodesy
acronym
coin / coined
...thus far
comprise
in-depth
thoroughly
central topic
exclusively
exogenous
amenable, be amenable to ...
exposition
contemporary
...is by no means to be ...
Rather, ...
descriptive
not infeasible
Such extensions, ...
characterize ...

appear, may appear to ...
provision
in the first place
vastly
overestimate
accommodate certain tasks
postulate
whereabout, the whereabouts of people
accrue ...
...as indicated
This chapter provides in detail ...
projectile
...concerned with ...
a comprehensive introduction into / to ...
subfield
monograph
overarching
temporal / spatial extension
commonality
discourse
insofar, insofar as ...= to the degree that ...
wordy
laborious
at times
...emerge with ...
superficial
exposition
planetary
be in one's infancy
in the proximity of ...
First and foremost, ...
perturb / perturbation
heavy-duty
wear-and-tear
flaky
rather crude
realm
stumble / stumbling

pay tributes to ...
Put differently, ...
ambiguity
degree of belief
in the face of ...
graceful / gracefully
pertain, ...pertaining to ...
distinguishable / indistinguishable
plausible
by no means does ...
momentary
err
deprive
paramount
coastal
anticipate / anticipation
cut across
reactive / proactive
relieve
insurmountable
sole
sound
...come at a price
weak link
unprecedented
bargain, at bargain prices
branch into / out
self-explanatory
pitfall
set forth, ...set forth below
virtually
familiarize ...
predominant / predominantly
brevity, ...lies in its brevity
coincide / coincidence
a final concept of importance
stray
..., so as to ...

revolute joint
...entails that ...
...be mediated by ...
single out ...
for didactic reasons
tactile, tactile sense
query
Hypothetically (speaking), ...
in accordance with ...
in the material yet to come
stochastic / stochasticity
time step
...will be explored pervasively
...as to ...
...is that of ...
reflect
synonym
elucidate
by virtue of ...
know ...with certainty
be entirely ignorant about ...
restrict ourselves to finite situation
postulate
violate / violation, induce violations of the assumption
as a (general) rule of thumb
ramification, have important ramification on ...
with no unique best answer for all ...
a wide array of ...
attain
by induction
predate
easy / involved
scent / scented / unscented
immense / immensely
treatment
provision
be amenable to ...
it is descriptive of the state of the art

preliminary
accrue
pendulum
steer, steering wheel
articulate / articulated
limb
hexagon
clockwise / counterclockwise
It accepts as inputs ...
hypothesize / hypothesized
moderate
it suffices to ...
perturb
handy
...amounts to ...
retro-, retrospect
formula / formulae
in lieu of ...
erroneous
slippage
This poses no problem for ...
side-step
in action
superimpose / superpose
...pertaining to ...
call for ...
keep ...into account
upon executing ...
factorize ...into
be subsumed into ...
.... One then ...
traverse / traversal / traversable
significant overhead
importance factor
Care has to be taken in ...
...leading up to ...
discard the information
shed light on / onto ...

As far as ...
sideward
estate, real estate
disguise, in disguise
tactile sensors
fire a signal towards ...
reflective surface
predictable
be paraphrase as ...
specular reflection
problematic
the likelihood of this to happen
coal mine
caveat
herein, Herein lies a key advantage of ...
hereinafter
crude
saturation
recapitulate / recapitulation
drop the distinction between ...and ...
adopt
be among the most popular / important ...in ...
range finder
phantom, phantom readings
eyeball
susceptible, be susceptible to ...
a plain implementation
the main drain of ...
run the danger of ...
ad hoc
pre-compute
advantageous
diminish
myriad, a myriad of ...
devise
indeterminacy
spiral
ring

introspection
with the advent of ...
alleged
by virtue of the fact that ...
inferior / superior
inflate
enabling technologies
in the pursuit of ...
deceptive / deceptively, deceptively simple / easy
While ..., despite ...
at present
be largely credited for / to ...
strive hard for / to
As we strive to ...
centerpiece
layman, a layman introduction to ...
roam
be endowed with ...
door post
fallen out of fashion
easy to reason about
speculate / speculation
a flurry of ...
intimate, intimate relationship / contact
be intimately related to ...
vanilla, a vanilla ...
in the very beginning of ...
persist, ...persists over time
provisional
novice, be novice in ...
in the light of ...
monolithic
trunk, tree trunk
overlay / overlaid, ...overlaid on ...
depletion
an educated guess
elapse / elapsed, time elapsed
in the spirit of ...

oracle
be suspected to ...
hurdle
hinder
hamper
sidestep
a close-up view of ...
considerable
be anticipated to ...
a wealth of information
fire hydrant
visual imagery
commodity
be in line with ...
histogram
ramp
quadrant
trigonometry
that's the case
judge by yourself / judge on yourself
time to wrap up
file an issue
run into issues / problems
tray
whale
synopsis
seasoned
dialect
directive
dictation
comply with ...
cutting-edge
what appears to be computationally easy in one parameterization is involved
in the other, and vice versa.
...stems from ...
alternate ...with ...
up front
subsume

curvature
render ...inapplicable to all but the most trivial problems
distort / distortion
resort to ...
incur
a logical choice
...deemed ...
contender
cooperation and division of labour
It's difficult in that ...
bring ...to bear on / upon ...
...has to do with ...
at times
be in stark contrast to ...
In a nutshell, ...
artificial beacons
intolerable
ceiling
kidnap / kidnapped / kidnapper
One might argue that ...
other than ...
Of particular interest are ...that ..., and that ...
accommodate noise / dynamics
through some other means
hazard / hazardous
impasse, recognize the impasse and escape from it
the hardness of the problem
coincide with ...
hallway
be flattened out
brittle
the most simple at all is ...
take ...for granted
thoughtful
reconcile
asymptotic / asymptotically
with relative ease
deposit

cliff
 distant
 tentative
 situate, ...situated in ...
 provision / provisional
 shrink / shrunk / shrinkage
 reduce ...by a significant factor
 in the face of ...
 lean
 ...deviates from ...
 reduce ...to ...
 It is therefore common practice to ...
 Little is currently known about ...
 distinctiveness
 scarce
 culminate in / into ...
 The advantages of ...are manifold: ...
 predate, ...predates ...by many centuries
 picture a situation where ...
 proactive
 selectively gist wraparound exploit for the sake of ...exposition fabricate / fabricated
 mandate be at odds with ...decentrally overhead, necessary overhead
 comparable facility for ...ethics / moral rod revenue, revenue figures obtainable
 inquiry ...as is we don't know ahead of time ...in a related, but slightly
 simpler, way to ...couch, couch ...in / as ...embody moderately, moderately
 large In retrospect, ...take as input ...save in the location ...a collapsed version
 coalesce be proportional to ...for clarity and conciseness discrepancy a short
 wrap-up a spectrum of ...proactive checkerboard practically, it's practically
 zero ..., where disks correspond to point features and dashed arcs to links logarithmic
 employ a technique / step circumvent extra conjecture take ...with
 a grain of salt rudimentary allusion cafeteria ...formerly at the head of the
 queue get rid of ...smear it's mathematically more sound random clutter the
 gold standard of ...fine-grained the number of ...are in the tens of thousands ...,
 namely ...decipher counterintuitive by virtue of ...the cell is free outweighed
 that of it being occupied have a hard time doing sth black correspond to
 ..., and white to ...make decisions exclusively based on ...disparity it's not an
 easy endeavor poll vignette at sb's disposal affirmative sink in some instances
 exhibit excellent performance in ...fielded systems a naive implementation if

not properly treated prevent the system from working ..., arguably the most popular ...to date turn our attention to ...narrow spikes unassailable henceforth, ...which henceforth will be called ...under mild conditions be unaware of the state repetitive daunting manifest the advantage is threefold culprit less pronounced deprivation wipe out last resort versatile lay the groundwork for ...throughout the remainder of the book However, this shall not deter us here Admittedly, ...low-end / high-end the ambiguity is resolved ...of practical importance It is not bound to a limited ...trade off ...and ...As our illustrative results suggest, ...blend ...seamlessly with ...paramount spread over a large volume a rather simple ...add an additional level of robustness If we were to ...This is even true for ...discuss in length Luckily, a simple trick provides remedy, ...Without delving into too much detail, ...depletion In a nutshell Whereas ..., ...be implemented in time logarithmic in the number of features descendant barring ...investigate it in more detail first principles be largely equivalent to ...On the surface, the difference looks rather marginal The reader may recall that ...This is problematic when ...a large spectrum of ...the mathematical derivation is more involved two orders of magnitude savings a sequence of ...of growing size decent, a decent job misalignment lecture hall grit workaround there's no black magic around that null points successive in a nutshell malicious be known a priori detrimental, be detrimental to ...You'll be a master by the time you're at my age one instance of this approach envision hopefully it helps more than hinders cluttered / clutter slippage / slip on the fly criterion / criteria equirectangular It is not without limitations when compared with ...One was already discussed:shows no such time dependence be superior in accuracy to ...elucidate, This difference will be elucidated below, where ...The basic intuition behind ...is remarkably simple pay tribute to ...induce a constraint It is linear in the time elapsed equally Attention has to be payed toculminate into ...book-keeping be composed of ...square matrix / quadratic matrix Subsequently, ...outline, The algorithm is outlined in Table 1 The quality of ...depends on the goodness of initial estimates derive from them the ...infinitesimal For now, it shall not concern us that, with a few differences pertaining tohighlights an essential characteristic of ...alleviate the problem by ...The interested readers shall be referred to the bibliographical remarks for more pointers to ...manifest itself by ...keep the computation low the techniques yield favorable results bipartite postpone ...has emerged from a number of different scientific fields a number of follow-up papers subterranean Following observations in ...SLAM is a highly active field of reasearch a more detailed elaborate model

artificial beacons pave the way from ...to ...seminal, seminal papers / seminal algorithms It parallels work by, albeit ...occasional from time 1 all the way to time t by virtue of ...issue command provision pay tribute to ...To efficiently solve many tasks envisioned to be carried out by mobile robots, ...parking garage a bird's eye view of the area with the sole use of its on-board sensors the advancement in the field of ...the synthesis of the method The transition model $p(x_t | x_{t-1}, u_t)$ is represented by the two edges leading to x_t and represents the probability that the robot at time t is in x_t given that at time $t - 1$ it was in x_t and it acquired an odometry measurement u_t . exteroceptive An alternative representation to ...isconsists in ...sensor dependent / sensor agnostic system integration It has many applications ranging from ...to ...interleave ...and ...Let ...and ...be respectively the ...andoriginates from ...Whereas ..., ...We first Subsequently, we ...workaround, a workaround that allow us to deal with ...An efficient yet compact implementation of the algorithm by dedinition / by construction between consecutive time frames a variant of ...reenter perturbation accordingly However, not appropriately considering the singularities leads to a divergence

12 Introduction to Algorithms

fertile at your /our disposal well / wells crew surmise present quite a challenge sketch out ...tantalize / tantalizing all the more be intrigued by / with ...fruitless / fruitlessness depot readily count on ...roadblock ever-increasing liken ...to ...elicit once craftiest programmer at the core of ...prominent Having ..., we then ...end (up) with ...at all times pile, a pile of ...get bogged down in ...wording short circuiting inferior algorithms abuse endeavor, endeavor to ...dexterity suppress, suppress tedious details ...that really interests us motif stop once ...bend, a tight bend an additional twist values that have yet to be copied values that will be copied over bottom up, bottom-up approach top down, top-down approach ...progresses from bottom to up division of the problem we reason as follow we have that ...an argument justifies this claim among other factors hyphen typeset in small caps interdependent After the line containing procedure name come one or more lines of code flush, flush the toilet / flush left in the eyes of ...For the most part, ...Mindful of request of our readers to ..., we ...ladder line up ...Upon seeing ...trail-and-error approach the references will resolve to the line numbers On rare occasions, ...out of order check ...against ...the initial call to either version the only way

in which ...a one-to-one correspondence between ...and ...the other way around
 be tailored to ...negligible an exhaustive search In so doing,: a contradic-
 tion. hallmark a simple inspection in spite of the two key ingredients that
 an optimization problem must have discuss more fully ...characterize ...con-
 tains within in ...supposition give rise to ...unless, Unless we could guarantee
 that ..., we would ...we first ...and, having ..., ...in a ...fashion informed, an in-
 formed choice / opinion ...as well be tempted to ...splice the index / vertex
 at which we ...excise ...in the sense that ...contradictory in greater detail ex-
 amine a problem ..., as does ...inspection, inspection of the procedure yields
 ...as a practical matter as a matter of fact ...saves us a significant amount of
 work ...fill in the table ...has yet to be filled in Each subsequent time that we
 encounter this problem, we ...upon ..., That depends on / upon the circum-
 stances Note where it resembles ...organism a strand of .../ a string of ...To
 be precise, ...eliminate the table altogether ...so as to ...a search will be for
 it caption, the caption of the figure nor can we necessarily ...an exhaustive
 search contiguous, a contiguous range ...has as its leaves ...There is one detail
 worth nothing about ...Bear in mind, ...For the base case, ...its for loops are
 nested three deep take on at most n values complacency