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From Ground Truth to Semantic Conformance Testing

Demonstrated by the Example of Face Image Data

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Agenda

- Conformance Testing
- Ground Truth
- Practical Approach
- Conclusion

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Conformance Testing
- Principles -

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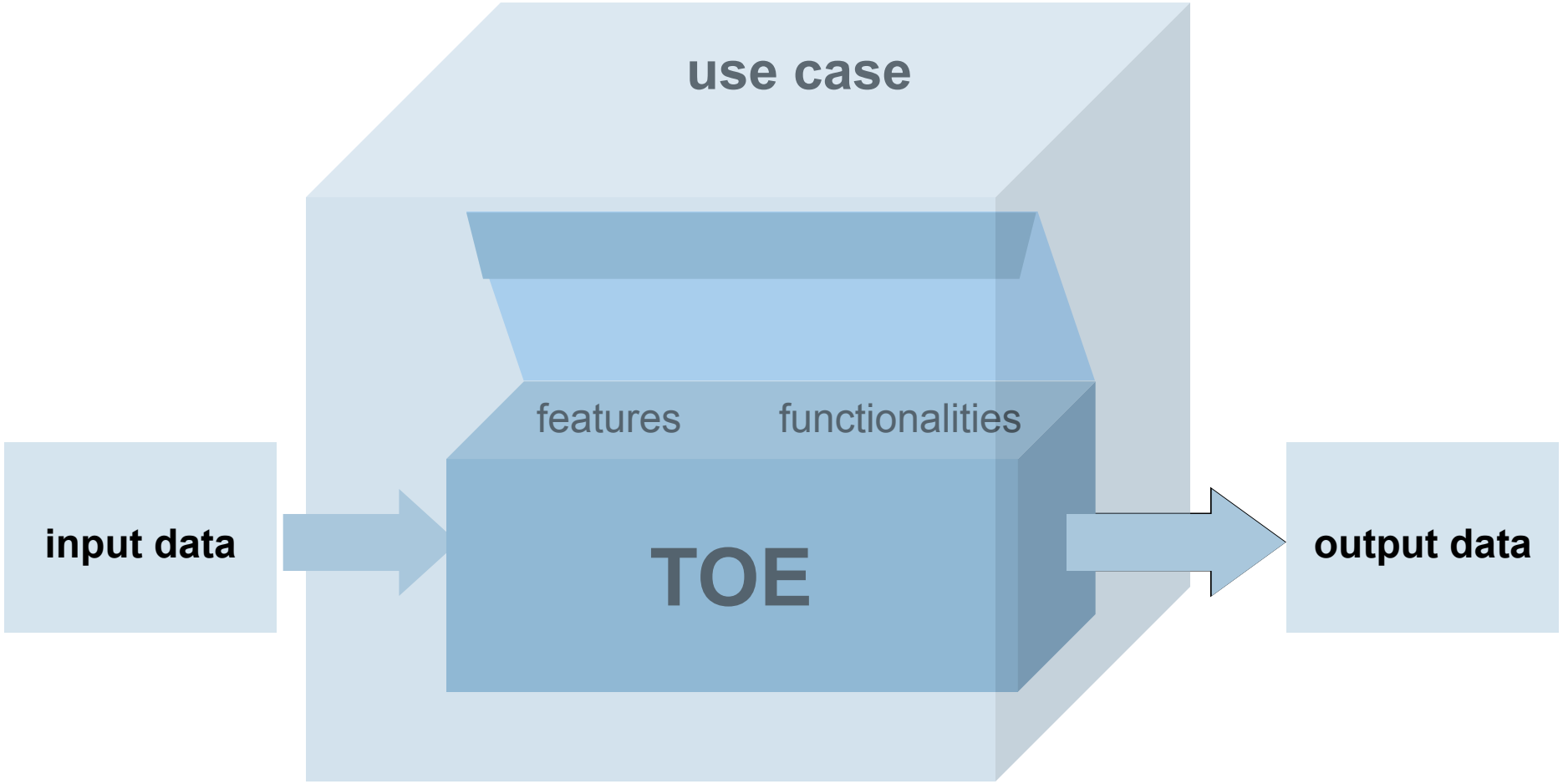

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Conformance Testing - Requirements -

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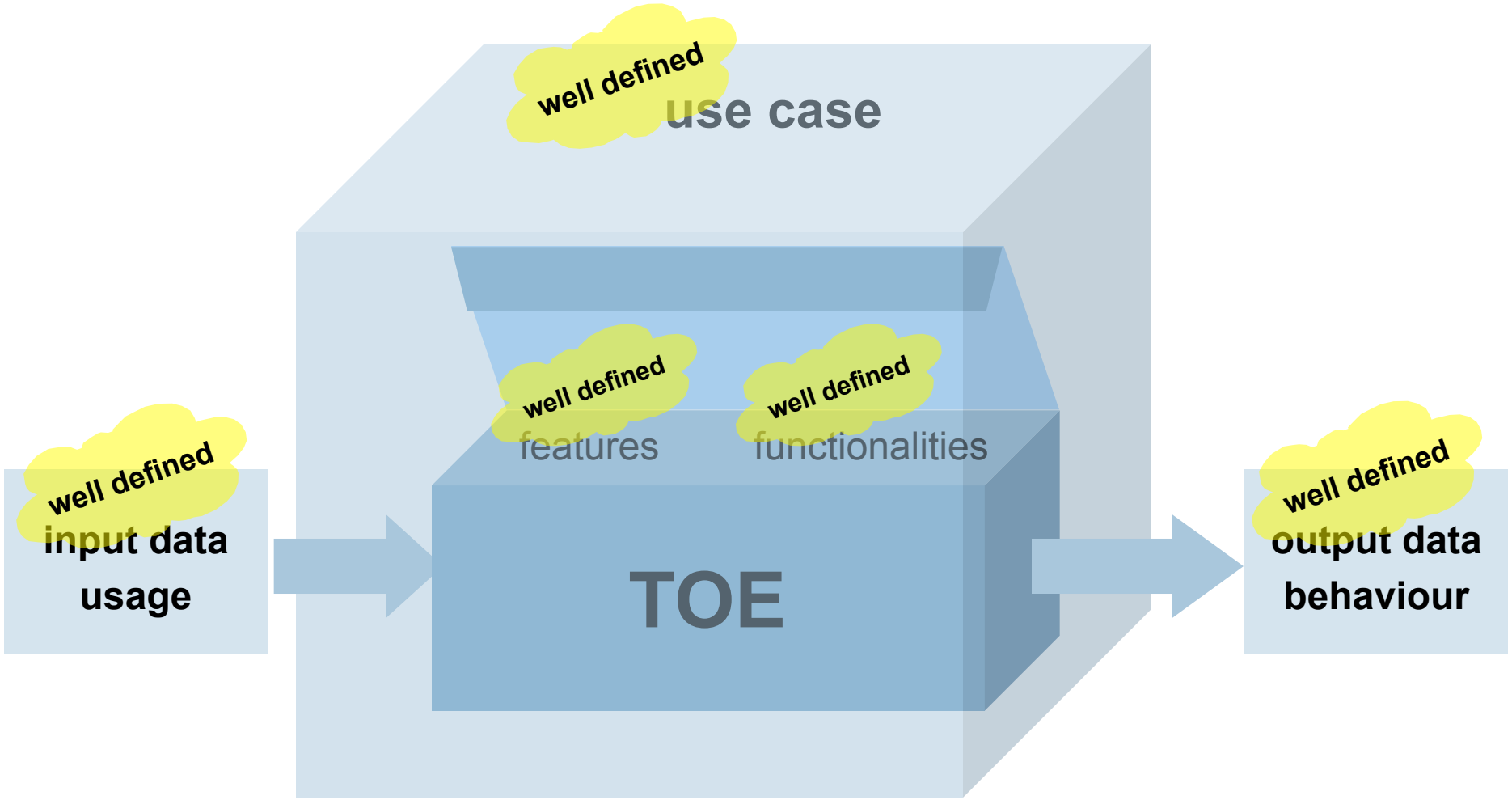

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Conformance Testing
- Specification Requirements -

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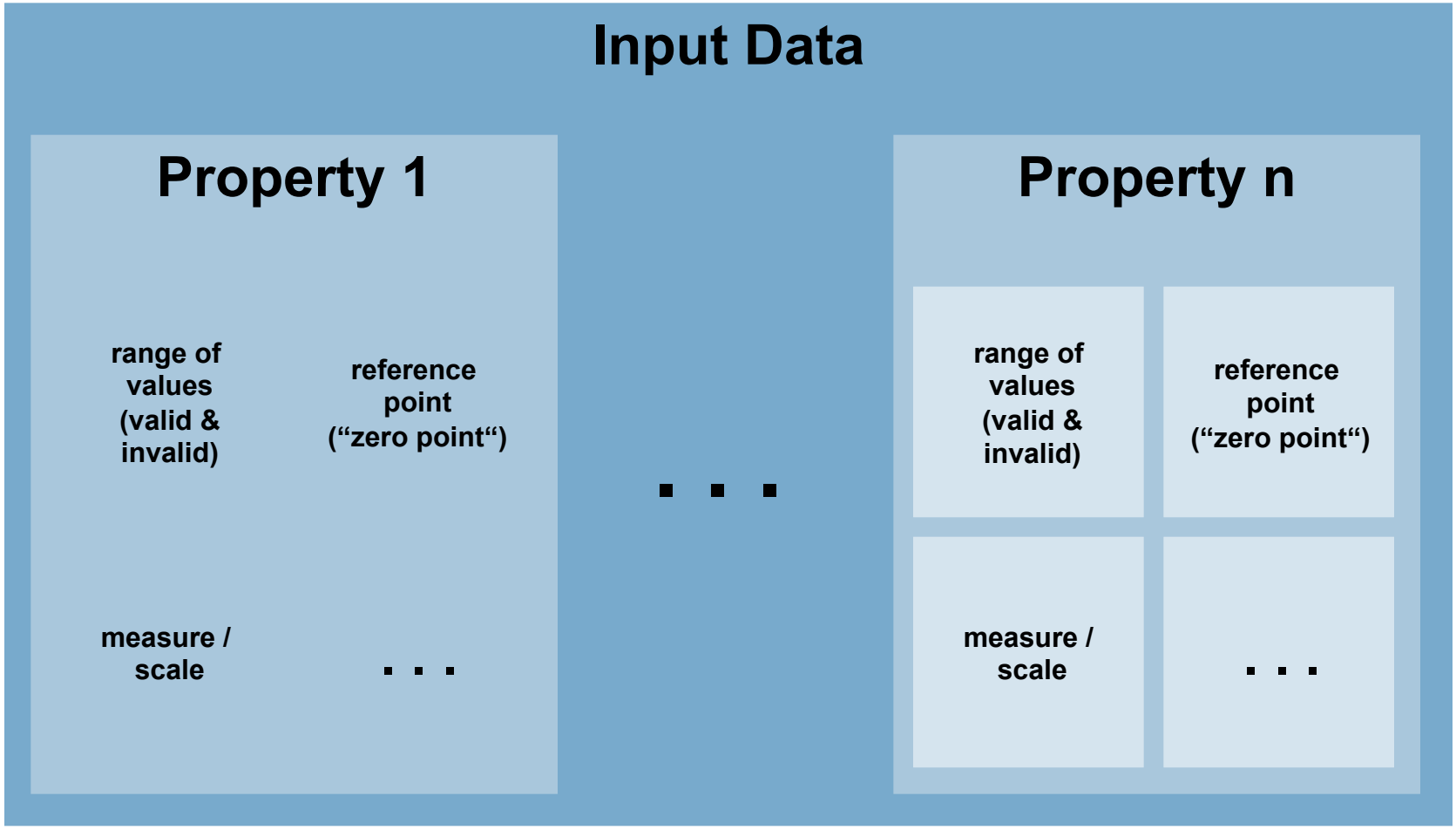

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Conformance Testing
- Test Data Requirements -

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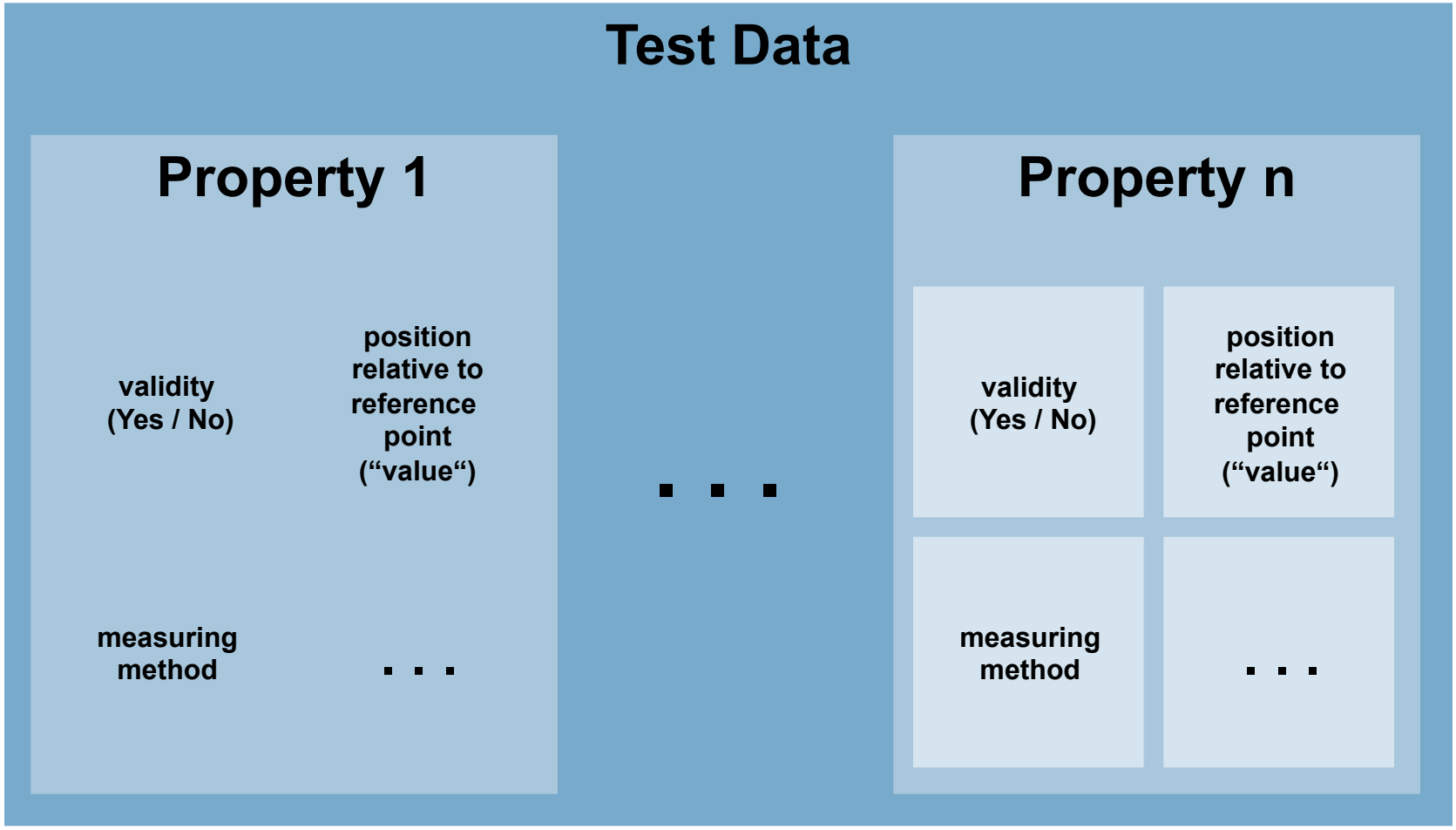

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Conformance Testing
- Test Data Requirements -

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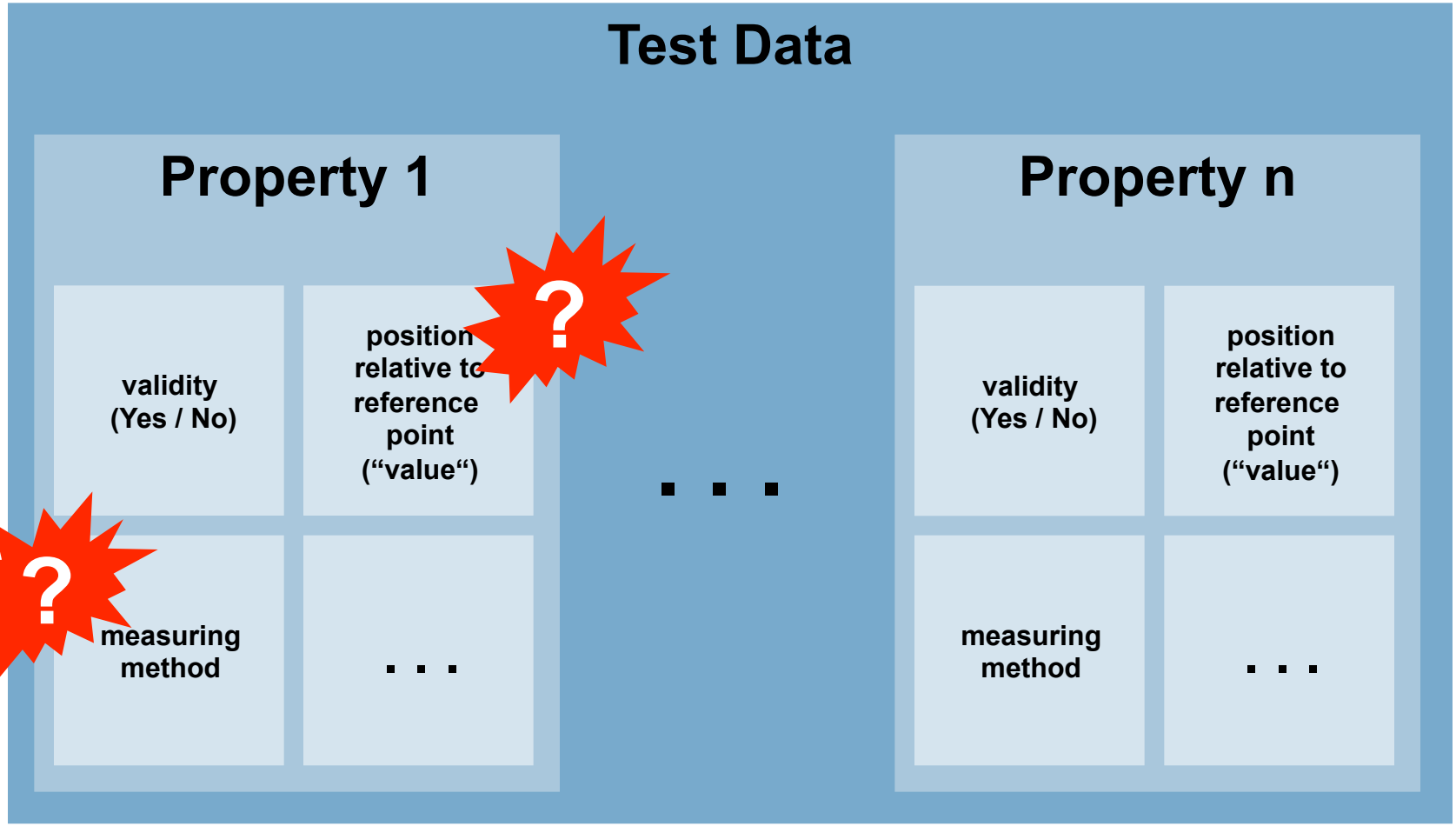

Ground Truth
- Definition -

Definition of Ground Truth in Biometrics

"Ground truth" is reliable biometric data captured within a ***defined setup*** with known parameters and combined with ***additional metadata*** that describes the properties of the biometric data determined by ***defined and documented mechanisms*** and/or scientific experts.

Ground Truth
- Measurability -

Characteristics of Standardized Properties

"Strict" Properties	"Soft" Properties
❒ well known & accepted reference/zero point ❒ defined range	❒ no well defined reference/zero point ❒ undefined range
⇩	⇩
measureable	not measureable

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Ground Truth
- Measurability Requirements -

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- measure has to be close to reality
- measure has to be internationally reproducible
- measure has to be applicable
- reference points have to be clearly seperated from each other

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Practical Approach
- Project Idea -

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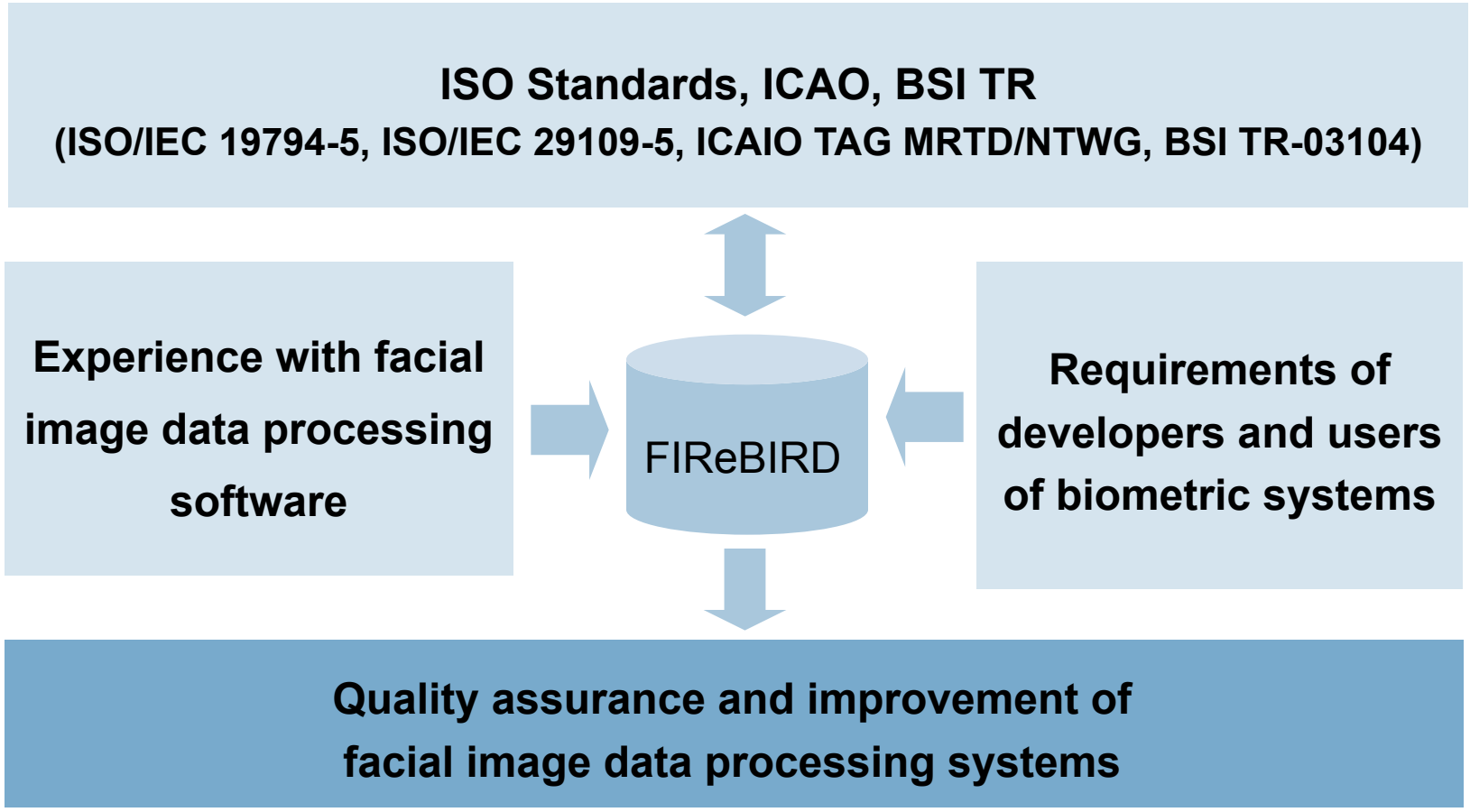

Practical Approach
- Realization -

Acquisition of valid and invalid images
(according to ISO/IEC 19794-5)

E. g. in respect to

- head gear, sun glasses, eye patches
- pose angles (pitch, yaw and roll), expressions
- lighting, shadows, under and over exposure, focus

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Practical Approach - Color Measurement -

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Eye Colour	Hair Colour	Skin Colour
❒ 5 colour classes (brown, grey-brown, multiple, gray-blue, blue) ❒ 3 colour depths (dark, medium, bright)	❒ 5 colour classes (black, brown, blond,grey, red) ❒ 3 colour depths (dark, medium, bright)	*in evaluation*
⇩	⇩	⇩
synthetic eyes	synthetic hair	spectrophotometer

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Practical Approach
- Eye Color Table -

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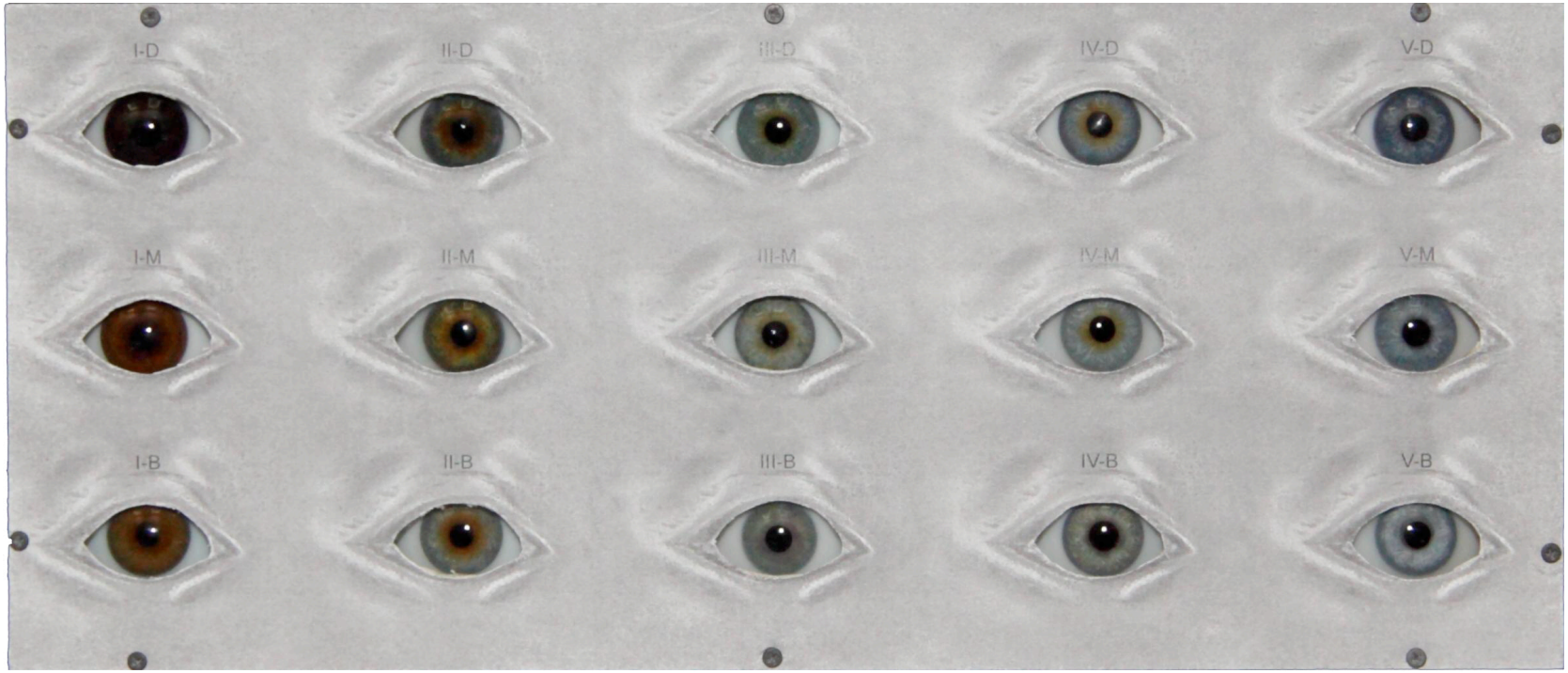

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Practical Approach
- Hair Color Ring -

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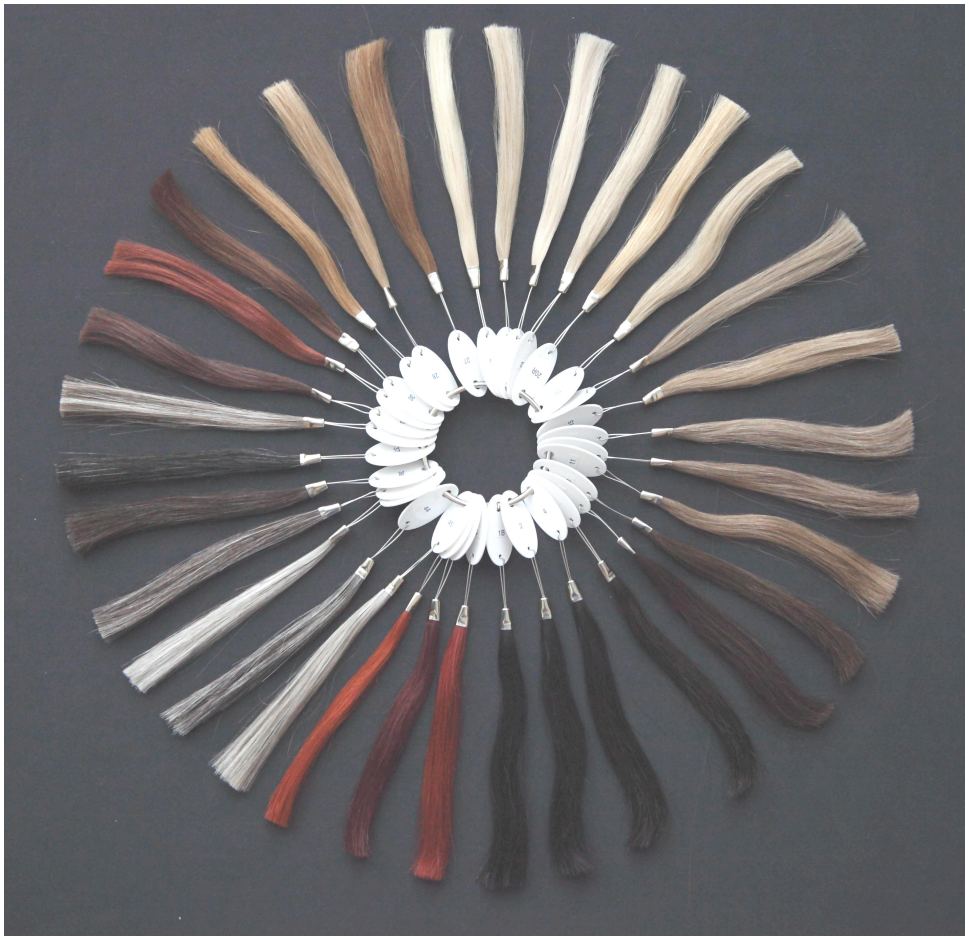

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Practical Approach - Miscellaneous Data -

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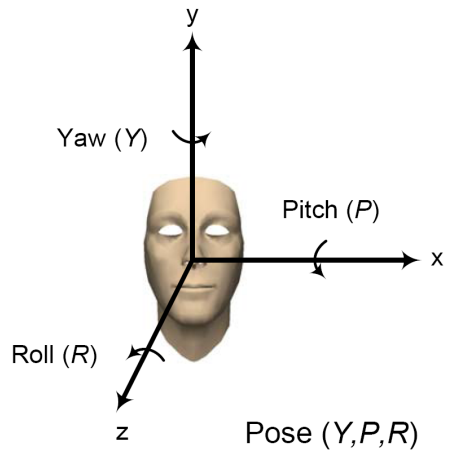
Shape	Personal Data	Miscellaneous
❒ head shape ❒ eye shape ❒ line of mouth ❒ ...	❒ class of age ❒ gender	❒ glasses ❒ hairdo ❒ makeup ❒ ...
↓	↓	↓
shemes	checklist	checklist

Practical Approach
- Handling “Soft“ Properties I -

Pose Variation – Looking for the Zero Point

- absolute zero point not defined
- aid: Frankfurt Plane
- problem: usually covered feature points



- extreme pose variation = killer for facial image processing
- standard has yet no answer

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Practical Approach
- Handling “Soft“ Properties II -

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15 x SLR cameras

- 1 central camera for full frontal view
- 8 cameras for vertical variation (pitch):± 4, ± 10, ± 20 and ±45 degrees
- 6 cameras für horizontal variation (yaw): ± 4, ± 10 and ± 20 degrees

3 x 3D scanner

- complete scan of the whole face
- no holes due to shadowing effects or occlusions

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Conclusion
- Quality Of Testing -

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Quality of testing depends on …

- quality / accuracy of specifications (standards, guidelines)
- quality of test methods
- reliability of test data.

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Conclusion
- Precision In Specification -

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Lacking precision in specification causes …

- less exact measurements
- vague conformance estimations

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Conclusion
- Lack Of Measure -

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Lack of measure hinders …

- development of conformant systems
- production of conformant data

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Conclusion
- “Zero Point“ -

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A scientifically definied “zero point“ is needed to …

- become a property measurable
- get a defined scale for measurement
- get comparable measurements
- determine whether a property is in line with a standard

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Conclusion
- Standardization Demands -

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Standardization has (at least) to define ...

- a scale
- a reference point (or “zero point“)
- value ranges

for every property / feature it deals with.

Thank You

For Your

Attention !

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Contact

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