



Aalto-yliopisto  
Perustieteiden  
korkeakoulu

# A Study on Evidence Theory: A General Representation of Uncertainty (topic presentation)

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Työn saa tallentaa ja julkistaa Aalto-yliopiston avoimilla verkkosivuilla. Muilta osin kaikki oikeudet pidätetään.

# Background

- A framework for reasoning with uncertainty
- First introduced by Arthur P. Dempster, developed by Glenn Shafer in the 1960s and 1970s
  - Also called Dempster-Shafer theory of evidence
- Combining evidence → degree of belief
- A general framework for formulating
  - possibility theory
  - probability theory
  - imprecise probabilities

# Evidence theory

- Belief measure
  - $Bel : P_X \rightarrow [0, 1]$
  - “Lower limit” of strength of evidence at hand
- Plausibility measure
  - Plausibility and belief form a duality, e.g.  $Pl(A) = 1 - Bel(\bar{A})$
  - “Upper limit” of strength of evidence at hand

# Evidence theory, an example

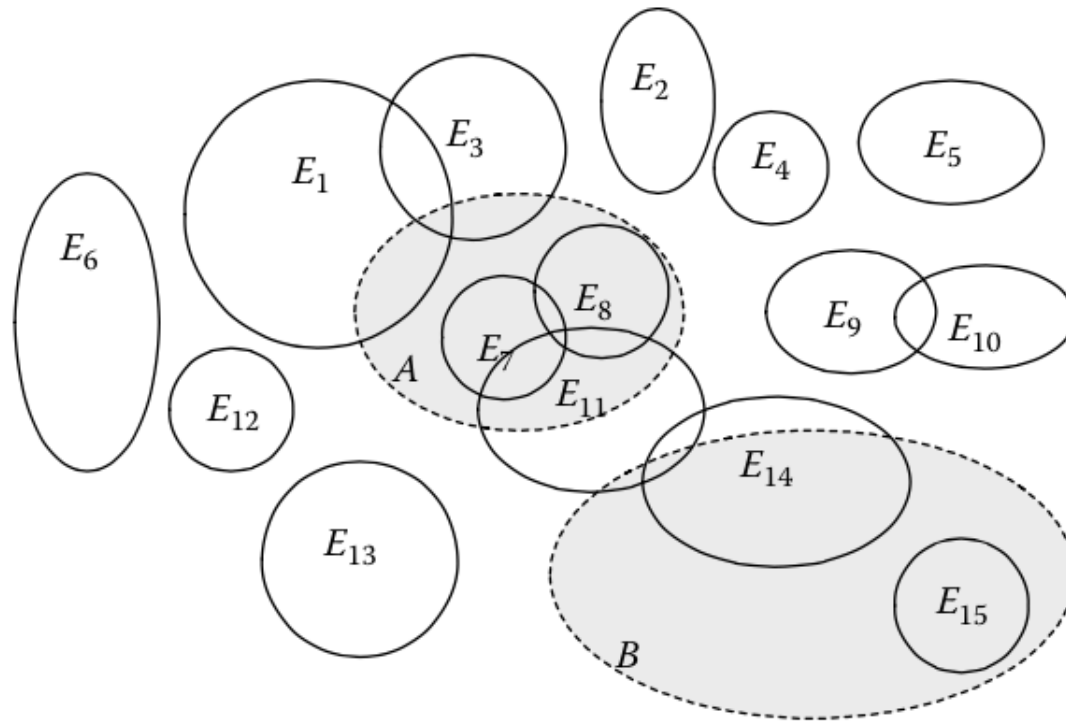


FIGURE 3.4 Estimates of the locations of the epicenter of an earthquake.

# Possibility and probability theories

- Possibility and necessity
  - Modeling of uncertainty where we attach two values to each event
  - Mappings from the power set of  $X$  to the values  $[0,1]$
- Probability theory
  - Older than evidence theory
  - Belief and plausibility can be interpreted in some cases as limits for probability

# Goals and scope

- Literature review -type
- Tutorial
  - Clear and easy to understand
- Evidence theory
  - Background
  - Belief and plausibility measures
  - Applications
- Connection to possibility and probability theories

# References

- Books

- Ayyub, Bilal M. and Klir, George J. *Uncertainty Modeling and Analysis in Engineering and the Sciences*. 2006.
- Wang, Zhenyuan and Klir, George J. *Generalized Measure Theory*, 2009.
- Shafer, Glenn, *A Mathematical Theory of Evidence*. 1976.

- Articles

- Fioretti, Guido. *A Mathematical Theory of Evidence for G.L.S. Shackle*. *Mind & Society*, 3, 2001, Vol. 2, pp. 77-98.
- Klir, George J. *Uncertainty in Economics: The Heritage of G.L.S. Shackle*. *Fuzzy Economic Review*, 2, 2002, Vol. VII, pp. 3-21.

# Timetable

- Topic presentation 23.2.2015
- First version ready 30.3.2015
- Thesis presentation 20.4.2015