

References

Ailon et al.: Preference-Based Learning to Rank

ailon10

N. Ailon and M. Mohri. "Preference-Based Learning to Rank." In: *Machine Learning* 80.2–3 (2010), pp. 189–211. Springer.

- useful keywords for future search: preference-learning to rank, preference-based, score-based
- some pointers to other learning to rank literature
- otherwise based on binary classification, thus probably not relevant here
- TODO: References

Ayaz et al.: Tangram Solved? Prefrontal Cortex Activation Analysis During Geometric Problem Solving

ayaz12

H. Ayaz, P. A. Shewokis, M. Izzetoglu, M. Cakir, and B. Onaral. "Tangram Solved? Prefrontal Cortex Activation Analysis During Geometric Problem Solving." In: *Engineering in Medicine and Biology Society (EMBC), 2012 Annual International Conference of the IEEE*. IEEE. 2012, pp. 4724–4727.

- experiment to measure brain activity during solving of a tangram
- right hemisphere is more active
- increase in brain activity similar to other cognitive tasks
- difference to arithmetic tasks with linguistic representation?

Baran et al.: How Do Adults Solve Digital Tangram Problems? Analyzing Cognitive Strategies Through Eye Tracking Approach

baran07

B. Baran, B. Dogusoy, and K. Cagiltay. "How Do Adults Solve Digital Tangram Problems? Analyzing Cognitive Strategies Through Eye Tracking Approach." In: *Human-Computer Interaction. HCI Intelligent Multimodal Interaction Environments*. Ed. by J. A. Jacko. Vol. 4552. LNCS. Springer, 2007, pp. 555–563.

- comparison of solution approaches for tangrams with varying difficulty
- differences shown in fixation count, task completion duration and transition number, part of the screen most focused on

Bell: Solving Tangrams Using JTS

bell12

B. Bell. *Solving Tangrams Using JTS*. Sept. 24, 2012. URL: <https://bjbell.wordpress.com/2012/09/24/solving-tangrams-using-jts/> (visited on 02/01/2015).

- difficulties when using floating point arithmetic
- take advantage of symmetry of the tangram pieces (e.g. use only one line segment of the square and only 2 of the 3 line segments of triangles)

- use heuristics when deciding which piece to fit first (e.g. use bigger pieces first and skip pieces when an identical piece has already failed to fit into a space (could this be relevant in generation))

Cai et al.: The Research on the Difficulty Grade and the Piecing Skills of Tangram **cai08**

S. Cai, Y. Jiang, and M. Zeng. *The Research on the Difficulty Grade and the Piecing Skills of Tangram*. Shenzheng Foreign Languages School. 2008. URL: <http://www.yau-awards.org/Notice.php> (visited on 1/19/2015).

- description of three ways to calculate the probability of the pattern, each requires to know all possible solutions to the pattern
- 1. way: probability based on correct placement of a piece and number of ways it could be placed (number of rotations that result into a different piece) - measure should result in the same probability for each solution and is just scaled by number of solutions (which is later scaled according to experiments again?)
- 2. way: probability based on possibilities to reach a certain length, unclear which length are being taken into account
- 3. way: probability based on cutting of basic shapes
- overall:
- patterns that are more regular are harder, patterns where there is only one possibility to place a piece are easier.
- seems computationally costly to automate (full solution computation and multiple orders of placement)
- (very bad English, should this be cited?)

Cheng et al.: An Algorithm for Automatic Difficulty Level Estimation of Multimedia Mathematical Test Items **cheng08**

I. Cheng, R. Shen, and A. Basu. "An Algorithm for Automatic Difficulty Level Estimation of Multimedia Mathematical Test Items." In: *ICALT '08 Proceedings of the 2008 Eighth IEEE International Conference on Advanced Learning Technologies*. IEEE. 2008, pp. 175–179.

- automatic difficulty estimation for computer-adaptive testing
- somehow based on response time
- more about how to construct the optimal test for each student using Item Response Theory (more difficult when correct answer, easier when wrong answer)

Cocchini: Wanderings Around Tangram **cocchini10**

F. Cocchini. *Wanderings Around Tangram*. Lulu.com, 2010.

- hard patterns have as many matched edges and vertices as possible
- percentage X of how far of the pattern is from being convex

- not written very good, only 3 chapters available

Coffin: The Puzzling World of Polyhedral Dissections - Chapter 1 - Two-Dimensional Dissections **coffin98**

S. T. Coffin. *The Puzzling World of Polyhedral Dissections - Chapter 1 - Two-Dimensional Dissections*. Ed. by J. Rausch. 1998. URL: <http://www.johnrausch.com/PuzzlingWorld/chap01.htm> (visited on 02/01/2015).

- tangram pieces arise when putting a diagonal square grid over the square -> each dissection line either follows the grid or diagonals of the grid (Figure 7)
- pieces made up of unit triangles, three of them "made up of two unit triangles joined all possible ways"
- figures created by arranging the pieces artistically are usually not considered to be true geometrical constructions since they do not conform to a regular grid
- examples for paradoxes (Figure 11)
- mentions multiple other dissection puzzles similar to the tangram, e.g. formed by using a finer grid, or cutting differently along the original square grid
- geometrical dissection usually refers to something else: "two different polygons being formed from the same set of pieces"

Cohene et al.: The Making of the Tangrambler **cohene02**

T. Cohene, S. Dack, O. Dufourmantelle, and M. Saunders. "The Making of the Tangrambler." In: *Human-Computer Interaction* 304 (2002), 424B.

- description of the design of a physical implementation of a Tangram game in several steps
- much analysis and evaluation based on HCI principles (as development of the prototype was part of an HCI course)
- Tangram also called "seven shapes of cleverness"

Deutsch et al.: A Heuristic Solution to the Tangram Puzzle **deutsch72**

E. S. Deutsch and K. C. Hayes Jr. "A Heuristic Solution to the Tangram Puzzle." In: *Machine Intelligence 7*. Bernard Meltzer and Donald Michie (1972), pp. 205–240. Edinburgh University Press.

- pieces are either three
- or four-sided → reduces the number of common edges two or more pieces can share
- proposed solution does not work for every tangram (puzzles with holes for example)
- combinatorics approach involves large amount of computation

- heuristic approach uses number of rules that are applied successively in a certain order
- based on splitting the puzzle in easier subpuzzles
- "number of corners or vertices of a tangram shape contains considerable information" → less corners give less information about the structure and how pieces are placed → solution for puzzles for 11 corners or more
- save tangram (Figure 4) as vertices' numbers and edge links (node
- (x,y) cords
- linked to node, edge length, direction)
- computation of so-called extension lines → convex (location of a piece) and concave (location of a line connecting two pieces) type vertices → disregard lines that are too short to support a puzzle piece or extension lines that are too close to a parallel edge
- multiple matching rules → direct, trying to fit multiple pieces all at once (composites also only three
- or four-sided)
- possible hints on how to find all possible location for one puzzle piece (?)

Duh et al.: Learning to Rank with Partially-Labeled Data

duh08

K. Duh and K. Kirchhoff. "Learning to Rank with Partially-Labeled Data." In: *Proceedings of the 31st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*. ACM. 2008, pp. 251–258.

- usage of unlabeled test data to improve ranking, generating better features and incorporating those features
- unsupervised learning algorithm to find pattern, then project training data onto these patterns and use resulting numerical values as new features
- keyword: Learning to Rank with missing labels

Eberle: The Role of Children's Mathematical Aesthetics: The Case of Tessellations

eberle14

R. S. Eberle. "The Role of Children's Mathematical Aesthetics: The Case of Tessellations." In: *The Journal of Mathematical Behavior* 35 (2014), pp. 129–143.

- study of children's aesthetics concerning tessellations and comparison of mathematician's view on them
- criteria usually mentioned by mathematicians when evaluating theorems or proofs: significance or depth, surprise, simplicity (clarity or elegance), connectedness and visual appeal
- "aesthetic judgment depends on one's background knowledge"

- "mathematical aesthetics serves three roles in education: a motivational role, a generative role, and an evaluative role"
- experiment: let children create tessellations and talk about them and given ones (partially in groups); then analyze what they have been saying
- number of aesthetic themes (in total 18) emerge from analysis, most often mentioned: Real World Connection, Color, Complexity, Uniqueness, Energy, Interconnectedness → "neither too simple nor too complex were usually the most interesting"
- additionally often mentioned by mathematicians (but not so often by children): Dimensionality, Symmetry, Surprise, Randomness
- children more confident when creating symmetric patterns, preferring convex shapes

Eisenman et al.: Aesthetic Preferences of Art Students and Mathematics Students

eisenman64

R. Eisenman and S. Coffee. "Aesthetic Preferences of Art Students and Mathematics Students." In: *Journal of Psychology* 58 (1964), pp. 375–378.

- create art-students prefer complex, often asymmetrical polygons, while math-students prefer symmetrical ones
- Birgkhoff as mathematicians may have been biased towards simpler shapes when devising his formula
- results are "inconsistent with an objectivist viewpoint which maintains that there is something inherent within objects that makes them universally beautiful"

Elffers: Tangram. Das alte chinesische Formenspiel

elffers76

J. Elffers. *Tangram. Das alte chinesische Formenspiel*. Du Mont, 1978

. Faria et al.: Learning to Rank for Content-Based Image Retrieval

faria20

F. F. Faria, A. Veloso, H. M. Almeida, E. Valle, R. d. S. Torres, M. A. Gonçalves, and W. Meira Jr. "Learning to Rank for Content-Based Image Retrieval." In: *Proceedings of the International Conference on Multimedia Information Retrieval*. ACM. 2010, pp. 285–294

. Filonik et al.: Measuring Aesthetics for Information Visualization

filonik09

D. Filonik and D. Baur. "Measuring Aesthetics for Information Visualization." In: *Information Visualisation, 2009 13th International Conference*. IEEE. 2009, pp. 579–584

. Fox-Epstein et al.: The Convex Configurations of “Sei Shonagon Chie no Ita” and Other Dissection Puzzles **foxepstein14**

E. Fox-Epstein and R. Uehara. “The Convex Configurations of “Sei Shonagon Chie no Ita” and Other Dissection Puzzles.” In: (2014). arxiv preprint: arxiv:1407.1923v1 [cs.CG]

. Galanter: Computational Aesthetic Evaluation: Past and Future **galanter12b**

P. Galanter. “Computational Aesthetic Evaluation: Past and Future.” In: *Computers and Creativity*. Springer, 2012, pp. 255–293

. Galanter: Computational Aesthetic Evaluation: Steps Towards Machine Creativity **galanter12a**

P. Galanter. “Computational Aesthetic Evaluation: Steps Towards Machine Creativity.” In: *ACM SIGGRAPH 2012 Courses*. SIGGRAPH ’12. New York, NY, USA: ACM, 2012, 14:1–14:162

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C. A. Garabedian. “Birkhoff on Aesthetic Measure.” In: *Bulletin of the American Mathematical Society* 40.1 (1934), pp. 7–10. American Mathematical Society

. Goldberg et al.: A Global Approach to Automatic Solution of Jigsaw Puzzles **goldberg02**

D. Goldberg, C. Malon, and M. Bern. “A Global Approach to Automatic Solution of Jigsaw Puzzles.” In: *Proceedings of the Eighteenth Annual Symposium on Computational Geometry*. ACM. 2002, pp. 82–87

. Haraguchi et al.: How to Produce BlockSum Instances with Various Levels of Difficulty **haraguchi12**

K. Haraguchi, Y. Abe, and A. Maruoka. “How to Produce BlockSum Instances with Various Levels of Difficulty.” In: *Journal of Information Processing* 20.3 (2012), pp. 727–737

. He et al.: A Survey on Learning to Rank **he08**

C. He, C. Wang, Y.-X. Zhong, and R.-F. Li. “A Survey on Learning to Rank.” In: *2008 International Conference on Machine Learning and Cybernetics*. Vol. 3. IEEE. 2008, pp. 1734–1739

. Hunt et al.: Difficulty-Driven Sudoku Puzzle Generation **hunt07**

M. Hunt, C. Pong, and G. Tucker. “Difficulty-Driven Sudoku Puzzle Generation.” In: *UMAP Journal* (2007), pp. 343–362

. Jarušek et al.: Difficulty Rating of Sokoban Puzzle **jaruvsek10**

P. Jarušek and R. Pelánek. "Difficulty Rating of Sokoban Puzzle." In: *STAIRS 2010: Proceedings of the Fifth Starting AI Researchers' Symposium*. IOS Press. 2010, p. 140

. Jarušek et al.: What Determines Difficulty of Transport Puzzles? **jaruvsek11**

P. Jarušek and R. Pelánek. "What Determines Difficulty of Transport Puzzles?" In: *Proc. of Florida Artificial Intelligence Research Society Conference (FLAIRS 2011)*. 2011, pp. 428–433

. Joshi et al.: Aesthetics and Emotions in Images **joshi11**

D. Joshi, R. Datta, E. Fedorovskaya, Q.-T. Luong, J. Z. Wang, J. Li, and J. Luo. "Aesthetics and Emotions in Images." In: *Signal Processing Magazine* 28.5 (2011), pp. 94–115

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J. Köller. *Mathematische Basteleien - Tangram*. 1999. URL: <http://www.mathematische-basteleien.de/tangram.htm> (visited on 02/01/2015)

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S. Z. Kovalsky, D. Glasner, and R. Basri. "A Global Approach for Solving Edge-Matching Puzzles." In: (2014). arXiv preprint: arXiv:1409.5957v1 [cs.CV]

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S. Kriegler. "The Tangram - It's More Than an Ancient Puzzle." In: *The Arithmetic Teacher* 38.9 (1991), pp. 38–43

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H. Li. "A Short Introduction to Learning to Rank." In: *IEICE Transactions on Information and Systems* 94.10 (2011), pp. 1854–1862

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S. Loyd. *Sam Loyd's Book of Tangrams*. Dover Recreational Math. Dover Publications, 2007

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T. W. Malone. "What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games." In: *Pipeline* 6.2 (1981), p. 50. ERIC

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T. W. Malone. "What Makes Things Fun to Learn? Heuristics for Designing Instructional Computer Games." In: *Proceedings of the 3rd ACM SIGSMALL Symposium and the First SIGPC Symposium on Small Systems*. ACM. 1980, pp. 162–169

. Marchesotti et al.: Discovering Beautiful Attributes for Aesthetic Image Analysis **marchesotti14**

L. Marchesotti, N. Murray, and F. Perronnin. "Discovering Beautiful Attributes for Aesthetic Image Analysis." In: *International Journal of Computer Vision* (2014), pp. 1–21. Springer

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T. Martins and M. Tsuzuki. "Simulated Annealing Applied to the Irregular Rotational Placement of Shapes Over Containers with Fixed Dimensions." In: *Expert Systems with Applications* 37.3 (2010), pp. 1955–1972

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I. C. McManus. "The Aesthetics of Simple Figures." In: *British Journal of Psychology* 71.4 (1980), pp. 505–524

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H. J. McWhinnie. "A Review of Research on Aesthetic Measure." In: *Acta Psychologica* 28 (1968), pp. 363–375

. Murray et al.: Learning to Rank Images Using Semantic and Aesthetic Labels **murray12**

N. Murray, L. Marchesotti, and F. Perronnin. "Learning to Rank Images Using Semantic and Aesthetic Labels." In: *BMVC'12*. 2012, pp. 1–10

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J. G. Nicholls and A. T. Miller. "The Differentiation of the Concepts of Difficulty and Ability." In: *Child Development* (1983), pp. 951–959. JSTOR

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K. Oflazer. "Solving tangram puzzles: A connectionist approach." In: *International Journal of Intelligent Systems* 8.5 (1993), pp. 603–616

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C. Orellana-Rodriguez, W. Nejdl, E. Diaz-Aviles, and I. S. Altingovde. "Learning to Rank for Joy." In: *Proceedings of the Companion Publication of the 23rd International Conference on World Wide Web Companion*. WWW Companion '14. 2014, pp. 569–570

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E. V. Perez, L. M. R. Santos, M. J. V. Perez, J. P. de Castro Fernandez, and R. G. Martin. "Automatic classification of question difficulty level: Teachers' estimation vs. students' perception." In: *Frontiers in Education Conference (FIE)*, 2012. IEEE. 2012, pp. 1–5

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R. C. Read. *Tangrams: 330 Puzzles*. Dover Publications, 1965

. Ringel: Denkspiele aus aller Welt - Tangram **ringel02**

C. M. Ringel. *Denkspiele aus aller Welt - Tangram*. Universität Bielefeld. 2002. URL: <http://www.mathematik.uni-bielefeld.de/~ringel/puzzle/puzzle02/tangram.htm> (visited on 02/01/2015)

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J. J. Roberge. "Tangram Geometry." In: *The Mathematics Teacher* 70.3 (1977), pp. 239–242. National Council of Teachers of Mathematics

. Scott: Convex Tangrams. **scott06**

P. Scott. "Convex Tangrams." In: *Australian Mathematics Teacher* 62.2 (2006), pp. 2–5. ERIC

. Siqueira Júnior et al.: A Novel Algorithm to Verify the Solution of Geometric Puzzle Games **siqueira09**

M. Siqueira Júnior, R. M. Alves, E. W. G. Clua, E. B. Passos, C. R. d. Silva, A. A. Montenegro, and J. C. Oliveira. "A Novel Algorithm to Verify the Solution of Geometric Puzzle Games." In: *Proceedings of the 2009 VIII Brazilian Symposium on Games and Digital Entertainment*. IEEE Computer Society. 2009, pp. 9–16

. Slocum: The Tangram Book **slocum03**

J. Slocum. *The Tangram Book*. Sterling Publishing, 2003.

- Sam Loyds book full of errors (7)
- mention of Japanese dissection puzzle (Sei Shonagon) (12)
- proof of pythagoran theorem as origin of tangrams? (15)

- name not originally chinese (23)
- found original, mostly later, dates to published tangrams claimed to have other publishing dates (60)
- paradoxal tangrams (100)
- many tangram examples

Spencer et al.: An Introduction to the Golden Tangram and its Tiling Properties

spencer05

S. Spencer et al. "An Introduction to the Golden Tangram and its Tiling Properties." In: *Renaissance Banff: Mathematics, Music, Art, Culture*. Canadian Mathematical Society. 2005, pp. 31–36

. Taylor et al.: Procedural Generation of Sokoban Levels

taylor11

J. Taylor and I. Parberry. *Procedural Generation of Sokoban Levels*. Tech. rep. LARC-2011-01. University of North Texas, 2011

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S. Vembu and T. Gärtner. "Label ranking algorithms: A Survey." In: *Preference learning*. Springer, 2011, pp. 45–64

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walravens07

H. Walravens. "Notes on the Early History of the Tangram in Germany." In: (2007). *Cubism For Fun: CFF72*

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wang42

F. T. Wang and C.-C. Hsiung. "A Theorem on the Tangram." In: *The American Mathematical Monthly* 49.9 (1942), pp. 596–599

. H. Wang et al.: Rating Logic Puzzle Difficulty Automatically in a Human Perspective

wang12

H. Wang, Y.-W. Wang, and C.-T. Sun. "Rating Logic Puzzle Difficulty Automatically in a Human Perspective." In: *Proceedings of DiGRA Nordic 2012 Conference: Local and Global–Games in Culture and Society*. 2012

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L. Wang, J. Lin, D. Metzler, and J. Han. "Learning to Efficiently Rank on Big Data." In: *Proceedings of the Companion Publication of the 23rd International Conference on World Wide*

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C. Xu and W. Xu. “The Model and Algorithm to Estimate the Difficulty Levels of Sudoku Puzzles.” In: *Journal of Mathematics Research* 1.2 (2009), pp. 43–46

. Zhou et al.: An Algorithm for Creating Geometric Dissection Puzzles **zhou12**

Y. Zhou and R. Wang. “An Algorithm for Creating Geometric Dissection Puzzles.” In: *Proceedings of Bridges 2012: Mathematics, Music, Art, Architecture, Culture*. Tessellations Publishing. 2012, pp. 49–56