Author’s response to reviews

Title: Temporally constrained ICA with Threshold and its application to fMRI data

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Author’s response to reviews:

Dear editor,

Enclosed is our latest revision of our manuscript, BMIM-D-17-00220, entitled ‘Temporally constrained ICA with Threshold and its application to fMRI data’. We appreciate very much the opportunity granted to us to resubmit our revised paper. And we are grateful to the two reviewers for their insightful and helpful comments for us to improve our work. We have attempted to address the concerns from the two reviewers and to follow their constructive suggestion to the fullest extents possible. It is our sincere hope that you and the reviewers find our responsive is acceptable and satisfactory.

Review 1

Comment 1

The paper is logically presented, but needs to be edited by a native english speaker for many grammatical and spelling errors.

Our response
Thank you for pointing it out. Our revised manuscript was polished by the American Journal Experts (https://www.aje.com/). 

Comment 2

On line 152, this simplification of FastICA negentropy cost not obvious. Given that this is a significant change to the FastICA cost, some additional clarification here is needed.

Our response

Thanks for your comment. The simplification of FastICA negentropy cost was used in FastICA algorithm in Hyvarinen’s study (Hyvarinen,1999). Moreover, we added some more descriptions in the revision based on your comment (see line 119-122, page 6).

“For the Negentropy J(y) in equation(2), v is a Gaussian variable and is unrelated with the variable y. The first-order derivative of J(y) is $2\alpha(E\{f(y)\}-E\{f(v)\})$. Therefore, the maxima of Negentropy are obtained at certain optima of $\alpha$, and the objective function of FastICA can be simplified as (Hyvarinen,1999).”

Hyvarinen A. Fast and robust fixed-point algorithms for independent component analysis. IEEE Transactions on Neural Networks 1999, 10(3):626-634.

Comment 3

I think the comparisons with FastICA, TCICA and GLM more consistent. Some results are compared across only a subset of these comparison methods, and it would make more sense for example, to compare across all methods in all experiments.

Our response

Thanks for your comment. Similar comment was raised by the second reviewer. In the revision, we applied TCICA-Thres, FastICA, TCICA and GLM to the activation pattern comparison in the simulation of single subject, the simulation of multi-subject analysis and the real fMRI experiments. The corresponding method description in section 3.1.6, 3.2.5 and 3.3.5 was revised (see line 218-226 on page 11, line 262-281 on page 13, line 310-319 on page 15). The new results and the corresponding discussion were added in the revision (see line 352-400 on page 17-19, Figure 4,5 and 6, line 454-498 on page 21-23).

For the robustness to the noise magnitude in the simulation of single subject, we aimed at investigating how the performance of TCICA-Thres in separating each task-related component
varied with noises. Because only TCICA-Thres and FastICA can successfully separate the two task-related components, we only compared TCICA-Thres and FastICA in section 3.1.3. So it is not meaningful to compare the robustness of TCICA-Thres with TCICA and GLM.

Comment 4

If, in the region near the temporal reference, the FastICA cost function is being used, why is it that the unconstrained FastICA cannot simply find all those extrema on its own, given enough time to explore the cost surface? I think discussion and clarification of this point would be useful.

Our response

We agreed that the unconstrained FastICA can find all the extrema on its own given enough time. However, the unconstrained FastICA needs to estimate all of the independent components from a dataset, which results in high computational time costs and the requirement to select the desired task-related components. In contrast to FastICA, TCICA cannot successfully extract all the independent components that are related to the same task although TCICA can automatically separate one target component without estimating all the components by using the temporal constraint. In this study, we aimed to automatically separate all the components related to the task without estimating all the components by improving TCICA. Therefore, we proposed TCICA-Thres method that combined the advantages of FastICA and TCICA. The basic idea of TCICA-Thres is to perform TCICA outside the threshold to remove all the extreme points that are far from the temporal reference and perform FastICA inside the threshold to keep all the extreme points close to the temporal reference. We further emphasized the motivation of the proposed TCICA-Thres and further pointed out the difference between TCICA-Thres and FastICA in the discussion section in the revision (see line 421-428 on page 20, line 457-460 on page 21).

“To separate all the task-related components automatically, TCICA-Thres combines the advantages of both TCICA and FastICA. TCICA-Thres sets a threshold to judge if the estimated parameter is close to the temporal reference. When the iteration is near the temporal reference, TCICA-Thres replaces the cost function of TCICA with the cost function of FastICA to keep all the extreme points close to the temporal reference. Otherwise, TCICA-Thres uses the cost function of TCICA to remove the extreme points that are far from the temporal reference. Therefore, TCICA-Thres can automatically extract all the components related to the same task without estimating all the components.

Our simulated data indicate that the TCICA-Thres and FastICA method can successfully extracted all the target brain networks participating in the task from fMRI data, although the task
activated two networks (see figure 4A-B). In contrast to FastICA, TCICA-Thres can automatically separate the task-related ICs without estimating all the components.”

Comment 5

Why is the TCICA-Thres method so robust to poor temporal references? Given that even at the worst case (CC=0.61) there is no negligible loss in performance, it would be interesting to see how low this can go before performance drops, and where the authors think this robustness comes from.

Our response

Thanks for pointing out the issue. According to your suggestion, we enlarged the range of correlation coefficient (CC) between the temporal reference and the true time course underlying the second component to investigate how low this can go before performance drops. In the revision, CC between the 13 temporal references and the time course of IC2 was set to 0.3199, 0.3335, 0.3527, 0.3779, 0.4095, 0.4469, 0.4891, 0.5542, 0.6165, 0.7069, 0.7867, 0.8548 and 0.9248 respectively (see line 186-189 on page 9). The new results were presented in Figure 3 in revision (see line 337-345 on page 16).

“Figure 3 shows the mean ROC areas of the two ICs that were extracted by TCICA-Thres for various temporal references. It can be seen that the mean ROC area of IC2 increased with the increasing of the CC between the temporal reference and the time course underlying IC2 for both the low noise level (CNR=0.14) and the high noise level (CNR=0.08) (see Figure 3B). When CC is below 0.55, the mean ROC area of IC2 dropped fast. However, the mean ROC of IC1 showed slight variation when CC between the temporal reference and the time course underlying IC2 increased. Because the correlation between each temporal reference in TRef and the true time course underlying IC1 is 0.9884, 0.9896, 0.9911, 0.9927, 0.9944, 0.9957, 0.9960, 0.9917, 0.9809, 0.9441, 0.8888, 0.8196 and 0.7548, the mean ROC area of IC1 decreased for the last temporal reference.”

Moreover, we also discussed why the TCICA-Thres method is so robust to poor temporal references (see line 437-449 on page 20-21).

“Furthermore, TCICA-Thres kept high performance and showed slight variations when CC between the temporal reference and the time course underlying the component was higher than 0.55 (see figure 3B). Moreover, the mean ROC area of TCICA-Thres dropped below 0.6 for CC less than 0.35. The results indicated that the TCICA-Thres method has a good robustness to the temporal reference. Because the temporal reference only helps TCICA-Thres remove the irrelevant extreme points, the performance of TCICA-Thres does not largely depend on the temporal reference. As long as the temporal reference shows some correlation with the task,
TCICA-Thres can easily get rid of most extreme points that are unrelated with the task. When the iteration is close to the temporal reference, FastICA will help TCICA-Thres extract all the final task-related components. For the real fMRI data, the temporal reference is usually derived from the convolution of task paradigm with the ideal HRF. Although it is impossible to know the true HRF that underlies the real fMRI data, the inaccuracy of temporal reference will not have much impact on the performance of TCICA-Thres in the real fMRI data analysis.”

Comment 6:

Why does ROC performance for IC2 seem to be better at lower CNR (Fig 3A vs Fig 3B)?

Our response

The ROC areas of IC2 at CNR=0.08 showed a little bit higher than that at CNR=1.4 in the original Figure 3 of the previous manuscript. Because such difference is very small, it is not reliable and may be attributed to the chance. In the revision, we re-investigated the robustness of TCICA-Thres to the temporal reference. The new results in Figure 3 in revision showed that the ROC area of IC2 still showed very slight differences between the two CNR levels for CC larger than 0.6. However, the ROC area at CNR=1.4 was larger than that at CNR=0.08 for CC less than 0.6. Moreover, the new results showed slightly higher performance at CNR=1.4 than CNR=0.08 for CC larger than 0.6(see Figure 3B). So the slight difference between CNR=0.08 and CNR=1.4 in the case of CC larger 0.6 was not reliable, which suggested that there was no significant difference between the two CNR levels for high CC.

Comment 7

Why does TCICA (Fig 6F) perform so poorly, compared to say, GLM, which also only finds "one component"?

Our response

GLM is able to detect all the brain regions that are activated by a task. In contrast to GLM, ICA can distribute the brain regions responding to a task into different brain networks. TCICA can automatically to extract one task-related component. If there is one component related to the task in fMRI data, it is easy for TCICA to find the extreme point that was close to the temporal reference. However, when fMRI data contained more than one components that were related to the same task, temporal reference may constrain TCICA to find the extreme point that was close to the temporal reference. Because the task-related component that was extracted by TCICA was not the true task-related sources, it showed smaller activation than TCICA-Thres, FastICA and GLM. Therefore, TCICA does not work well in fMRI data that contained more than one
components related to the same task. We added the corresponding discussion in the discussion section of the revision (see line 468-474 on page 22).

Comment 8

Why are the spatial correlations (Fig. 7) with GLM so poor? I think this warrants further discussion, because the added value of ICA here is in separating out sub-components associated with a single task, which GLM cannot do. But if this comes at huge cost in overall sensitivity, which it appears so, then the cost-benefit of this technique may not be favorable.

Our response

Thanks for your comment. In the simulated data, we have the ground truth of activation. So we don’t calculate the correlation between the results of GLM and ICA methods. However, for the real fMRI data, it is impossible to obtain the ground truth of activation. In order to compare the performance of different ICA methods, we suppose that the results of GLM are the ground truth and calculate the correlation of GLM and ICA methods. Because GLM and ICA belong to two different types of methods, the brain regions that were estimated by GLM and ICA won’t be totally the same. ICA may detect the regions that GLM cannot detect. Therefore, the results of the two methods cannot show high correlation. In our previous study, the mean spatial correlation of GLM and various ICA methods also showed correlation lower than 0.4 (Wang, 2014). It is well-known that GLM is a univariate method while ICA is a multivariate method. Thus, GLM cannot be used to extract the brain networks underlying various cognitive process from fMRI data while ICA can, which is the main advantages of ICA over GLM. Although the ICs of TCICA-Thres and FastICA showed low correlation with GLM in real fMRI data, the simulated data demonstrated that the ICs that were extracted by TCICA-Thres and FastICA had large ROC areas. Therefore, ICA is still a favorable technique even though its results show low correlation with GLM in real fMRI data.

Review 2

Comment 1

I think adding and choosing constrains brings extra manual step, taking ICA far from its original aim, being exploratory and modal free nature. But of course it has some advantages like focusing ICA to task-related activity by adding some constraints in mixing matrix which will lead to increase chance of detectability and gaining computation time. This study could be restructured on those two aims.

Our response
Thanks for your good comment. We agree that the increased detectability is the main aim of our study. However, gaining computation time is not the main aim of this study. Thus, we did not do much work to compare the computation time of different methods. Actually, the proposed TCICA-Thres is obviously faster than FastICA because TCICA-Thres can automatically extract the target components. However, its computation time was only comparable to TCICA and won’t be faster than TCICA. The advantage of TCICA-Thres over TCICA is that it has better ability of detecting the task-related components. Moreover, because GLM and ICA belong two different types of methods, comparison between GLM and different ICA methods is not the main purpose of this study. Even if ICA isn’t faster than GLM, it can separate different brain networks from fMRI data while GLM cannot. So this study did not compare the computation time between TCICA-Thres and TCICA/GLM.

Comment 2

To make a fair comparison in detectability, a task related mask preferably created by using GLM should be compared with all components of TCICA, TCICA-thres, FastICA instead of two chosen. That will give an idea how a method converges to a desired results.

Our response

Thanks for your comment. Similar comment was given by the first reviewer. In the revision, we applied TCICA-Thres, FastICA, TCICA and GLM to the activation pattern comparison in the simulation of single subject, the simulation of multi-subject analysis and the real fMRI experiments. The corresponding method description in section 3.1.6, 3.2.5 and 3.3.5 was revised (see line 218-226 on page 11, line 262-281 on page 13, line 310-319 on page 15). The new results and the corresponding discussion were added in the revision (see line 352-400 on page 17-19, Figure 4,5 and 6, line 454-498 on page 21-23).

Moreover, the real fMRI data showed that TCICA-Thres and FastICA can successfully separate the two task-related components while TCICA can only extract one task-related component, which already suggest that TCICA-Thres and FastICA showed better detectability than TCICA. Therefore, it is not meaningful to further calculate the correlation of TCICA and GLM and compare the correlation of TCICA-Thres, TCICA and FastICA.

Comment 3

Second main point is computation time; it’s kind of obvious to see if ICA with prior information would converge faster than blind ICA. I think for computation time assessment, all three methods should be compared with calculation time of GLM.
Our response

Thanks for your comment. We agree that it is obvious that TCICA-Thres is faster than FastICA. In the response to your comment 1, we pointed out that the computation time assessment was not the main purpose of this study. Thus, we did not do much work to compare the computation time of different methods. Actually, the computation time of TCICA-Thres was only comparable to TCICA and won’t be faster than TCICA. Moreover, we also tested the computation time of GLM in simulated data. The mean computation time of GLM is within 5 seconds that is a little bit slower than TCICA-Thres. Actually, the computation time of TCICA-Thres and GLM did not show big difference. Because GLM is a univariate method and ICA is a multivariate, GLM and ICA can reveal different information from data. In this study, we did not aimed at comparing ICA with GLM. So we are not interested in the computation time of GLM. Even if GLM is faster than ICA, ICA still shows advantages of extracting brain networks from fMRI data. So ICA and GLM cannot replace each other.

Comment 4

*Methods(Line23) are not matching with results (Line28), Line24: "(TCICA-Thres) method that performs TCICA outside the threshold and performs FastICA inside the threshold", comparison results of TCICA and TCICA-thres should be stated in Results(Line28)

Our response

Thanks for pointing out the issue. We corrected the description of results in the revision (see line 28-30 on page 2).

“Results: The results from the simulation and the fMRI data demonstrated that TCICA-Thres better extracted the task-related components than TCICA. Moreover, TCICA-Thres outperformed FastICA in robustness to noise, spatial detection power and computational time.”

Comment 5

Correlation is not ideal to assess temporal match, because depending on delays, same oscillating frequency (perfectly related with task) with a little shift could give a lower correlation coefficient. In this study TR=2s, is not adequate sampling task related delays but shape of the time course will be different. This should be discussed.

Our response

Thanks for your comment. We added the discussion of the correlation in the revision (see line 448-453 on page 21)
"In this study, correlation that depends on delays may not be ideal to assess temporal match. Same oscillating frequency (perfectly related with task) with a little shift could give a lower correlation coefficient. In this study, TR(=2s) is not adequate to sample task related delays. The observed time course will be different from the true time course that drives each IC. Therefore, correlation is not ideal to measure the temporal match between the reference function and the time course underlying each IC."

Comment 6

*Line70 "If there are more than one spatial components related to one task, ICA contrast function will contain more than one extreme points" Authors should consider to compare their new ICA method by using this contrast function.

Our response

Actually, the ICA contrast function won’t be changed no matter whether there are one IC or more than one ICs related to a task in data. Two contrast functions was used in TCICA-Thres. TCICA-Thres used the TCICA contrast function outside the threshold and the FastICA contrast function inside the threshold (see equation 6-8 in the revised manuscript). TCICA-Thres can be applied to the data that contained one task-related ICs as well as the data that contained more one ICs related to a task without changing contrast functions. Therefore, TCICA-Thres cannot be compared with TCICA-Thres using new contrast function you meant.

Comment 7

Line 78 "Accordingly, TCICA is not able to fully extract all the spatially independent components that are related to one task from fMRI data." There is an assumption that more than one or certain amounts of task-related components are expected. What is the relation of performance with respect to #of components? How many task-related components will validate any xxICA method is eligible to "fully extract" task-related components.

Our response

In reality, we don’t know how many components are related to each task in fMRI data. Some fMRI data may only contain one task-related IC while some fMRI data may contain more than one ICs that are related to one task. In the TCICA-Thres algorithm, we don’t specify how many ICs to be extracted. When the correlation between the time courses of the IC extracted by TCICA-Thres and the reference function of the task is lower than 0.5, the algorithm is terminated. In this study, it was known that the simulated datasets contained 2 ICs that were related with the same task. Therefore, two task-related components can validate that any xxICA
method is eligible to fully extract task-related components for the simulated dataset. However, for the real fMRI data, we don’t know the number of task-related ICs, we can only infer the reasonability from the spatial distribution of each IC. We added some discussion about how to terminate the TCICA-Thres algorithm in the revision (see line 525-530 on page 24).

“Moreover, because the number of the components that are related to a task in real fMRI data is unknown, the threshold is also used to determine whether the extracted IC is related to the task. The estimated component was considered as the task-related components when the correlation coefficient between the temporal reference and the time course of IC was greater than 0.5. Otherwise, the TCICA-Thres algorithm will terminate. For the TCICA algorithm, it is terminated when the correlation between the time course of IC and the temporal reference was lower than 0.5.”

Moreover, we also discussed how to validate that TCICA-Thres and FastICA fully extract task-related components for the real fMRI data (see line 479-484 on page 22).

“For the fMRI data, TCICA-Thres automatically estimated one task-related component that was engaged in visual processing and the other task-related component that was engaged in motor output. The two task-related components were also be identified by FastICA. Because the activated regions of IC1 and IC2 for TCICA-Thres and FastICA covered almost all the regions that were engaged in the task, the two methods successfully extracted all the ICs that were related to the task.”

Comment 8

*Line 87 "The current study is different from our previous study [10] because…” I think in the Introduction it is not necessary to start comparing with your previous work, would be better to mention first the aim of the work. A similar comparison can be made in Discussion section, while comparing the methods/results.

Our response

Thanks for pointing out the issue. We removed the sentence from the introduction. A similar comparison was added to the discussion section (see line 428-430 on page 20).

“Moreover, it should be noted TCICA-Thres is different from TSCICA that was proposed in our previous study [10]. TCICA-Thres only uses the temporal constraint while TSCICA uses both the temporal and spatial constraints.”
Comment 9

* Line91 "The spatial ICA was used in TCICA-Thres in the current study." Is better combined with previous sentence for the sake of clarity.

Our response

Thanks for pointing it out. The previous description was not accurate. Actually, TCICA, FastCIA and TCICA used the spatial ICA. In the revision, we mentioned it at the end of the introduction (see line 93-94 on page 5).

“It should be noted that this study used the spatial ICA for the TCICA-Thres, FastICA and TCICA methods.”

Comment 10

* Line94 "all the desired task-related" What do we really mean here by all the desired components? Authors might give a bit more detail here regarding the experiment, or an expected number of components per task, if exists.

Our response

We are sorry for the unclear description. In this study, “all the desired task-related components” means that all the components related to a task. Actually, we know the number of task-related ICs per task in the simulated data but don’t know that in fMRI data. In the response to your comment 7, we described how to terminate TCICA-Thres in order to obtain all the task-related components and how to validate TCICA-Thres and FastICA fully extract the task-related components from fMRI data. For fMRI data in this study, because the activated regions of ICs that were extracted by TCICA-Thres and FastICA covered most activated regions that were detected by GLM, it is reasonable to think that TCICA-Thres and FastICA extract all the ICs related to the task. Because we don’t know the number of component related to each task in the real fMRI data, we can only add the description of the number of tasks contained in the experiment (see line 88-90 on page 5).

“Using simulated and real fMRI experiments that contained one task, we investigated the robustness, the feasibility and the stability of the proposed method and compared TCICA-Thres with FastICA and TCICA.”

Moreover, we revised the discussion of the fMRI data in the new manuscript (see line 479-492 on page 22).

“For the fMRI data, TCICA-Thres automatically estimated one task-related component that was engaged in visual processing and the other task-related component that was engaged in motor
output. The two task-related components were also be identified by FastICA. Because the activated regions of IC1 and IC2 for TCICA-Thres and FastICA covered almost all the regions that were engaged in the task, the two methods successfully extract all the ICs that were related to the task. In contrast, TCICA can only extract one task-related component that consisted of most activated regions of IC1 and a few activated regions of IC2. Although the activated regions that were detected by TCICA-Thres and FastICA largely overlapped with the regions that were estimated by GLM, the activated motor cortex of the IC2 that was estimated by TCICA-Thres was much larger than that by FastICA. As a result, the activation pattern of TCICA-Thres showed a higher correlation with that of GLM compared to that of FastICA. In addition, TCICA-Thres showed better stability than FastICA, especially for IC2. The results from the real fMRI experiment further verified that TCICA-Thres outperformed TCICA and FastICA in spatial detection power.”

Comment 11

* Line96 Theory part, Sections of 2.1 and 2.2 were already introduced and being used in the literature, hence a detailed description is not necessary in the main text. I suggest removal of long explanation for FastICA and instead a summary can be added before following sections.

Our response

Thanks for your comment. According to your suggestion, we combined section 2.1 and 2.2 to one section and shortened the corresponding description in revision (see line 96-110 on page 5-6).

Comment 12

* Line 110 "Our proposed method is based on the FastICA algorithm. One sort of object function used in FastICA is negentropy that is defined in (4)[12]." This part rather should be in Sections 2.3, and Section 2.3 might be shortened for an easier flow, and details of the implementation, namely gradient decent optimization, and procedure could either be removed or moved to Appendix.

Our response

Based on your comment 11, the sentence “Our proposed method is based on the FastICA algorithm. One sort of object function used in FastICA is negentropy that is defined in (4)[12]” was removed from the revised manuscript. Moreover, we shortened the section 2.3 and moved “the gradient decent optimization and procedure” to the Appendix in the revised manuscript (see line 633-668 on page 28-29).
Comment 13

Please remove dots after the titles, i.e.(Line344 351 358 365 etc…)

Our response

Thanks for pointing out the issue. We removed all the dots after the titles in the revision.

Comment 14

* I'd suggest using fMRI data instead of "real fMRI data" but I realized that terminology already used in previous publication. fMRI data vs simulation already makes the distinction clear.

Our response

According to your suggestion, we used fMRI data in the new manuscript.

Comment 15

Figure 6 is it group results or single subject should be indicated in caption.

Our response

Figure 6 showed group results of the fMRI data. We corrected the caption of Figure 6 in the revision (see line 691-693 on page 30).

“Figure 6 Group spatial activation of the fMRI data. (A) The activated regions detected by GLM. (B) The spatial activation of IC extracted by TCICA. (C)-(D) The spatial activation of IC1 (C) and IC2 (D) extracted by TCICA-Thres. (E)-(F) The spatial activation of IC1 (E) and IC2 (F) extracted by FastICA. “

Comment 16

Figure 5 is hard to believe to be an independent component, to me looks like a mask. Please clarify.

Our response
Figure 5 showed the brain regions that have high weights in the independent component. As long as the brain regions were activated, we used red color to label it. We did not use the color bar to indicate the weights. Because the red color is unrelated with the weight of each voxel, the activated pattern looks like a mask.

Comment 17

Line 428 "Both TCICA-Thres and FastICA successfully detected two task-related components." Again assumption of certain number of task-related components, this should be clarified and relative literature should be cited.

Our response

When TCICA-Thres, TCICA and FastICA are applied to fMRI data, we don’t need to pre-specify the number of the components related to the task. When the correlation between the time course corresponding to IC and the task reference function is lower than 0.5, the TCICA-Thres and TCICA algorithm will terminate automatically. For FastICA, after all the ICs were estimated, the correlation between the time course of each IC and the task reference function was calculated. The ICs whose correlation higher than 0.5 was selected as the task-related ICs. Therefore, we don’t need to assume the number of task-related components for TCICA-Thres, TCICA and FastICA. The ICA algorithms can select the task-related ICs automatically. In the revision, we revised the description in the new manuscript (see line 378-379 on page 18).

“Two task-related components were extracted by TCICA-Thres and FastICA automatically.”

Comment 18

* Line 432 instead of "motor output of judgment" decision of finger tapping would be more suitable.

Our response

We revised it in the new manuscript (see line 380-382 on page 18).

“It can be inferred that IC1 was engaged in the visual processing and perception of objects and IC2 participated in the decision of finger tapping.”

Comment 19
* Line 440 It is not clear how activation mask was created? It is stated as "union of IC1 and IC2" but components of which ICA, fastICA or TCICA-thres? Ideally masks should be created by using GLM results.

Our response

We are sorry for our unclear description. The activation mask was created for FastICA, TCICA-Thres and GLM separately. We revised the description in the revision (see line 388-391 on page 18).

“To compare the results that were estimated by GLM, TCICA-Thres and FastICA, we generated activation masks of the three methods. For GLM, the activation mask was created by setting the activated voxels to 1 and the non-activated voxels to 0. For TCICA-Thres and FastICA, the activation mask of IC1 was added to that of IC2 to generate one activation mask.”

Comment 20

* Are there any other components among 28 that which have high spatial correlation with created activation mask?

Our response

For FastICA, we have to estimate 28 components. Among all the 28 components, there are no other ICs that have high spatial correlation with the activation mask, except our selected two components. For TCICA-Thres, only two task-related components were estimated. For TCICA, only one task-related component was estimated.

Comment 21

* Line 510 "TCICA-Thres showed better stability than FastICA, especially for IC2. Because TCICA-Thres does not need to estimate all the components, it had significantly higher computation efficiency than FastICA" This statement has quite outreaching claims, haven't seen any results in this work about comparison of computation efficiency. Either should be removed or relevant results should presented.

Our response

Thanks for pointing out the issue. We removed the sentence in the new manuscript.
Finally, thank you for your great patience and wisdom throughout this process.

Yours Truly,

Zhiying Long